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ABSTRACT

A natural history museum is a building where animals, plants, minerals, and other things in nature are kept and exhibited for study. This document is a curriculum guide to provide a variety of activities for educators and their students to use not only when visiting the International Wildlife Museum (Tuscon, Arizona), but also with natural history museums and wildlife displays everywhere. It consists of lesson plans and activity sheets grouped by grade level. Most lesson plans contain a materials list, time requirements, structure, resources, source, skills, objectives, background, procedures, closure, and extension. (MKR)

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Curriculum Activities Guide for Natural History Exhibits Grades K-8

International Wildlife Museum Tucson, AZ

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Curriculum Activities Guide for Natural History Exhibits Grades K-8

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The International Wildlife Museum's Curriculum Activities Guide for Natural History Exhibits

Grades K-8

THE INTERNATIONAL WILDLIFE MUSEUM'S CURRICULUM ACTIVITIES GUIDE FOR NATURAL HISTORY EXHIBITS

Grades K-8

A Publication of
International Wildlife Museum
4800 West Gates Pass Road
Tucson, AZ 85745
(602) 629-0100

July 1992

Dedicated To

Environmental Educators Everywhere

In recognition of their untiring efforts to communicate a rational ecological perspective to their students and to encourage conservation as a personal ethic.

and to

Our Youth, The Citizens of the Future

In whose hands the wise use and stewardship of the world's natural resources will rest tomorrow.

Acknowledgments

We wish to express our appreciation to the many people who helped develop this packet. Most of the educators making up the development team are active members of Arizona's Association For Learning In and About The Environment (A.A.L.E.). Their involvement as facilitators for Project WILD Workshops resulted in utilizing a similar format in presenting curriculum activities for this guide.

John Stair, Wildlife Extension Specialist, University of Arizona; Jean Contreras, Elvira Elementary, Tucson and Lorna Taylor, Mesa Verde Elementary, Tucson were instrumental in developing the initial proposal. Lorna Taylor also served as Division Leader — Primary Grades K-3; Patricia Regehr, Tucson assisting as did Jean Contreras, Intermediate Division Leader (4-6) with Jean Fields, Sahuaro School, Washington District, Phoenix assisting.

As all division members reviewed and commented on each others materials, recognition is also due to: Viki Dillahunty, Coronado Middle School, Tucson and Susie Criswell, Desert Hills/ Chapter 1 Teacher, Tucson making up the Middle School Division grades 6-8 and the Secondary Division members (9-12), Don Adams, Santa Rita High School, TUSD and Steven Marlatt, Willcox Middle School, Willcox.

A special thanks to Bob Miles, Information Specialist, Arizona Game & Fish Department, Tucson, who served as the initial editor and wildlife specialist in arranging all material presented into a standardized format. John Stair also served as a wildlife specialist and adapted the glossary of terms for this publication.

We would also like to acknowledge the following staff members who assisted with the final layout and printing: Karen Parker, Ann Wilson, Bonnie Swarbrick and Karen Crehan.

The International Wildlife Museum is indebted to the Safari Club International Sables and the International Wildlife Foundation for providing the funds which made this project possible.

A final thanks to the many educators who made this effort so rewarding.

Donald J. Brown
Education Director
Safari Club International

Holt Bodinson
Director
International Wildlife Museum

Introduction

Natural history museums are exciting places and rich resources for educators. The purpose and mission of a museum IS education and to provide life-long learning opportunities for publics of all kinds, interests and age levels.

Whether they be regional, national or international in orientation, local natural history museums offer immensely educational exhibits, reference collections, curriculum materials, and interpretive services. Museums are learning environments just waiting to be utilized more fully for formal and informal educational purposes.

At the International Wildlife Museum, our emphasis is on open, accessible and interactive exhibits—exhibits that engage the student and visitor as much as possible in the learning process by blending together artifacts, computer and video technology.

Our objective is to make the museum a continuous discovery room, and because of our location and cultural heritage, to provide interpretive information in more than one language. Indeed, today, the International Wildlife Museum serves a school audience drawn from Sonora, Mexico in the south to the furthest edges of Arizona. And because of our location in Tucson, a city which is a southwestern magnet for international tourism, we are fortunate to be able to work with a diverse community of visitors.

The museum has had a self-guiding "Previsitation Guide" for educators for several years. This new curriculum supplement guide was undertaken to provide a variety of activities for educators and their students to use not only when visiting the International Wildlife Museum but with natural history museums and wildlife displays everywhere.

We plan to revise and refine this guide is several years and urge you to send us your suggestions for changes or improvements after working with it. Above all, we hope you enjoy it and find it useful. Finally, if you are far away, please visit us when you are in the Southwest.

Holt Bodinson
Director
International Wildlife Museum

Don Brown
Education Director
Safari Club International

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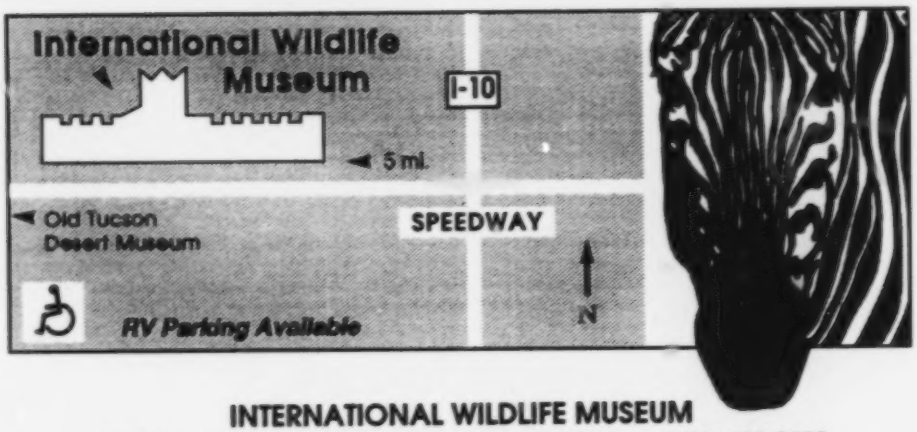
Location

On Speedway, just 5 miles West of I-10



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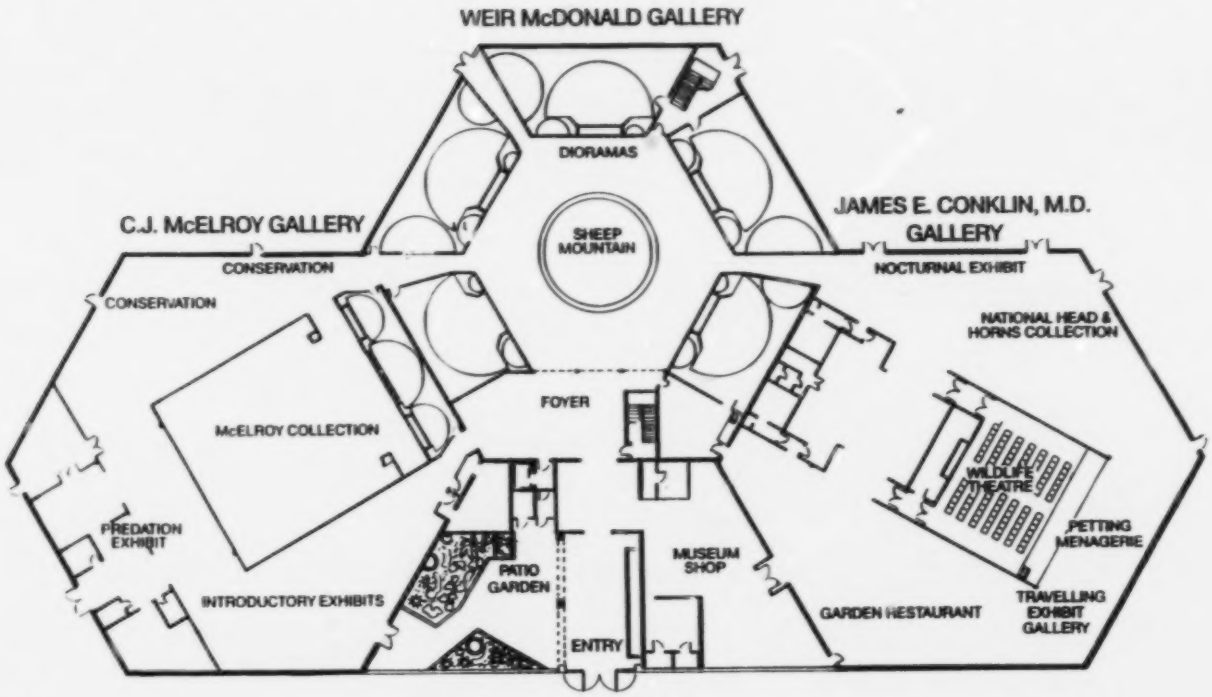

What is a Natural History Museum?

Natural History Museum. If you looked these words up in a dictionary you would find the following entries:

> ***mu-se-um (myu ze' em)**, n. a building or room where a collection of objects illustrating science, art, ancient life, or other subjects is kept and exhibited.*
>
> ***nat-ur-al (nat' er el) his-to-ry (his' tor ree)**, the study of animals, plants, minerals, and other things in nature.*

By putting these meanings together we find that a natural history museum is a building where animals, plants, minerals and other things in nature are kept and exhibited for study.

The International Wildlife Museum is a natural history museum exhibiting wildlife for study and appreciation by visitors. Hands-on exhibits help visitors learn the differences between furs, skulls, and horns and antlers by actually feeling them.

A look at taxidermy shows how animal skins are stretched over forms to produce life-like animals. These forms weigh only a few pounds and can be lifted by a child.

Predator and prey relationships are studied. The dog family and the cat family are compared in the ways that they hunt.

Dioramas show actual life-like habitats and relationships. A sheep and goat mountain shows the sheep and goats of the world and where they might be found on a mountain.

In the big gallery different species of animals around the world can be compared. Many of these animals you would never be able to see, either because they are so secretive, in remote wilderness or they are in another part of the world.

A journey through the Arizona desert at night shows some of the night creatures we know about but seldom see.

These and more await your visit. This is an exciting place!

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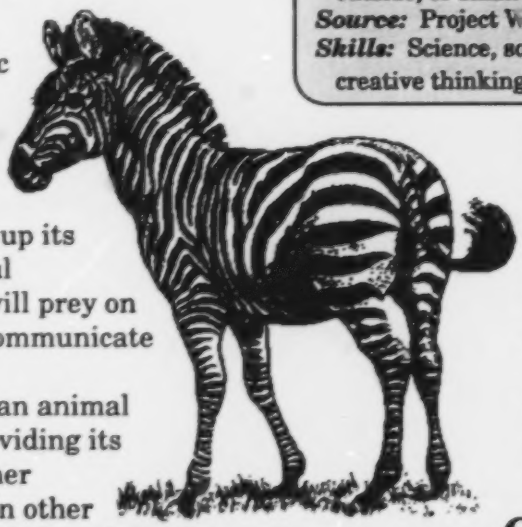
What Am I?

Grade Level: K-6
Materials: Chalkboard or chart for use by scorekeeper; chalk or pen, as needed.
Time required: 30 minutes.
Structure: Whole group activity inside or outside, or small groups.
Source: Project WILD.
Skills: Science, social studies, language arts, creative thinking.

Objectives:

The student will portray and recognize wildlife by its specific behavior and characteristics.

Background:

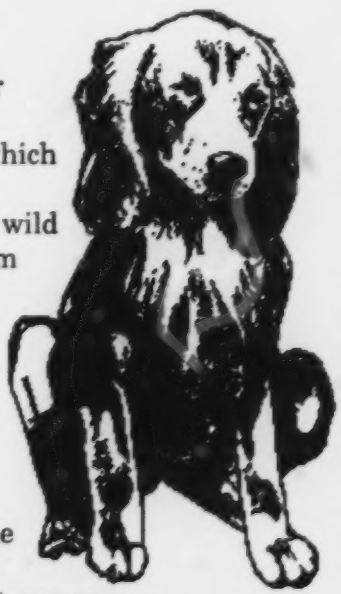


All animals have basic characteristics and behaviors unique to their species. A skunk will eat anything and defends itself by putting up its tail in order to emit a foul smelling spray. A wolf will prey on other animals and will communicate by howling. etc.

Wildlife is defined as an animal that lives on its own, providing its own food, shelter and other needs from its habitat. In other words, a wild animal basically takes care of itself and fulfills all needs for survival. A domesticated animal depends on humans to feed and take care of it. If a domesticated animal becomes wild, it is called "feral".

Procedure:

1. Divide class into teams or groups of 3 to 6.
2. Each team must decide which animal they wish to portray. Explain the difference between wild and domestic animals. The term **feral** may be introduced.
3. Demonstrate how behaviors of animals can be portrayed or acted out.
4. Individuals or groups take turns pretending to be animals chosen. When told to "begin" the audience guesses the charade with a 30-second time limit. Award points for correct answers.



Discussion:

1. What animals were easy to guess? Why?
2. Would a domestic animal be easier to portray? Why?
3. Which animals had behaviors unique to that species?

Closure:

Have students model or describe typical behaviors of wild and domestic animals.

Ask students to explain the difference between wild and domestic animals.

Extensions:

1. Animals which coexist can act together.
2. Classify animals for appropriate or inappropriate pets with reasons for the classification.
3. Students can create a story about an animal, describing typical or unique behaviors of that animal.
4. Have students research how structural adaptations have resulted in unique behaviors. (Apes use long arms to swing through trees.)

Meet My Friends

Objectives:

The student will classify animals according to what they eat.

The student will define herbivore, carnivore and omnivore.

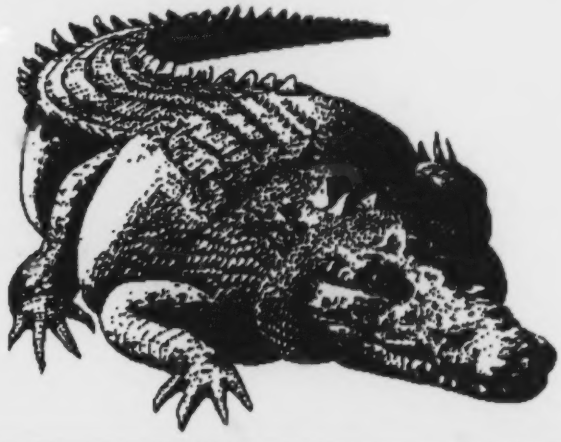
Grade Level: K-6
Materials: Chalkboard or chart.
Time required: 30 minutes.
Structure: Whole class.
Source: Lorna Taylor.
Skills: Problem solving, information gathering, critical thinking; comparing and contrasting.

Background:

Animals can be classified into categories by the food they eat. This is important in relation to the food chain, predator and prey relationships, and other interrelationships in the environment. Herbivores eat herbs, or plants; carnivores eat carne, Spanish for meat; and omnivores eat all things (omni- means all). Thus, an herbivore would eat only plants, but a carnivore or omnivore could eat any animal. Herbivores can be broken down further into grazers and browsers. Grazers eat grass and grassy plants, while browsers feed on leaves and twigs.

Procedure:

1. Draw a picture, or attach a picture to the board, of a cow or horse. Introduce it to the class as "Herby Voris," and write the name below the picture. Explain that he eats herbs, which is another name for spices, which come from plants. Therefore, he eats plants. He is called an "herbivore," and write the term below the name.



3. Explain that these animals have rather flat teeth, like our molars. (Have them run their tongues over their flat teeth in the backs of their mouths.)

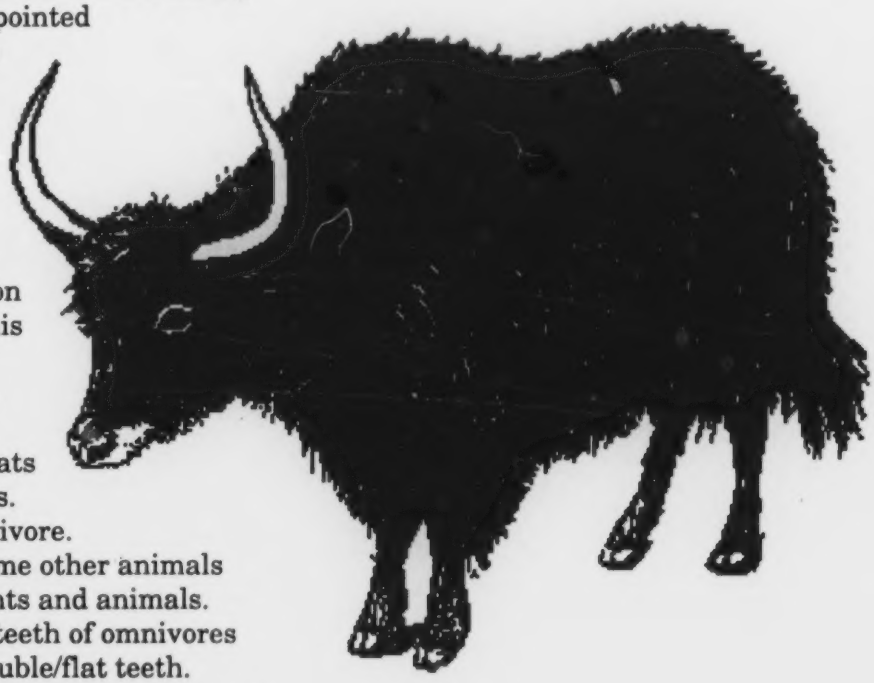
4. Explain that some of the plant-eating animals have really flat teeth, because they eat grasses, and these are known as "Grazers." Compare these to other plant-eating animals with double teeth that are more pointed, allowing them to eat leaves and branches of trees. These are known as "Browsers." These teeth are usually stained with tannin, a chemical in plants.

5. Draw a picture of a cat, or attach a picture to the board. Introduce this animal to the class as "Carny Voris," and write his name under the picture. Explain that he eats *carne*, which is Spanish for meat, and that he is a carnivore. Write the term under the name.

6. Have the class name other animals that eat only meat.

7. Explain that the teeth of meat-eating animals are sharp and pointed to chop up meat. These teeth are white. Have the students feel in their mouths for sharp teeth.

8. Next draw a picture of a boy, or put up a picture of a child, on the board. Introduce this animal to the class as "Omny Voris." Explain that "omni-" means all things, so this animal eats both plants and animals. He is known an an omnivore.



9. Have the class name other animals which will eat both plants and animals.

10. Explain that the teeth of omnivores have both sharp and double/flat teeth. Have them feel in their mouths to make sure that they have both kinds. These teeth are usually white.

Discussion:

1. Have the students review what they learned.

2. Review the terms of herbivore, carnivore, and omnivore and have the students give examples of each.

3. Give each student an activity page and have them find and classify animals. Their desk dictionary could be used as a resource.

Closure:

1. Ask the students to distinguish between herbivore, carnivore and omnivore.

2. Have students explain how kinds of teeth are clues to what an animal eats.

Extensions:

1. Use books or study pictures of other animals and ask students to predict whether it is an herbivore, carnivore or omnivore. Have them give their reasons for the prediction.

2. Have students draw animals and write about them, including whether they are an herbivore, carnivore or omnivore.

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Meet My Friends

Herby Voris

Carny Voris

Omny Voris

Herbs are plants and spices.	Carne is meat in Spanish.	Omni means all things.
Herbivore	**Carnivore**	**Omnivore**

List the animals that fit each category.

Mule Deer	Dog	Pig
Buffalo	Wolf	Black Bear
Desert Bighorn Sheep	Domestic Cat	Human
Cottontail	Mink	Coatimundi
Impala	Mountain Lion	Gray fox
Pronghorn Antelope	Coyote	Raccoon
Elephant	Jaguar	Skunk
Mouse		

Draw your own animal. Is it a herbivore, carnivore, or omnivore? What does it eat?

Predator Or Prey

Grade Level: K-8
Materials: Blindfolds for each member of the class.
Time required: 30 minutes.
Structure: Whole Class - outside.
Source: Bob Hernbrode.
Skills: Problem solving, information gathering, critical thinking.

Objectives:

The students will model the adaptations and behaviors which enable animals (predator and prey) to survive.

Background:

All animals are either hunted by others for food (prey) or hunt others for food (predators). Each has its own special adaptations.

Each prey species has a certain call which allows it to find others of the same species. Their eyes are on the sides of their heads and work independently of each other, allowing them to see all around them for predators which might attack them. They also stand in an alert stance listening for predators.

Predators, on the other hand, usually have eyes which face forward and can focus on prey in order to estimate distance. The predator's body is usually in a forward position ready to pounce on its prey.

Procedure:

1. Select one student to be a predator. Tell the rest of the class to pair off as different kinds of prey.

2. Each pair decides what kind of a prey animal they are and develops an appropriate call which they will use to find each other.

3. Explain the rules as follows. Everyone will be blindfolded. There will be no talking - only animal noises. When a predator catches an animal with two hands, she/he must clap twice. The captured animal must remove the blindfold and move to the outside of the circle to watch, but silently. When a pair finds each other, they also remove their blindfolds and move to the outside to watch quietly.

4. Take the class outside (if not already there). Have each pair stand together in a big circle around the predator. Review the rules. Then have them put on blindfolds.

5. Take one of each pair and lead him/her to the opposite side of the circle.

6. When all are in place give a signal for all animals to find their partners. Review that the predator must catch them with two hands and then clap twice.

7. When most of the animals have either been caught or found each other, stop the game and have everyone remove their blindfolds.

8. Bring everyone back into the building, or have them sit in a group for discussion.

Discussion:

1. Ask students what they learned from the activity.

2. Ask how many pairs found each other. In the wild a pair might be a reproductive male and female. This assures that the species will continue.

3. How many animals were caught? What if these pairs were the only ones of that species? (That species could become endangered or extinct.)

4. Ask the students to describe how they stood or used their bodies to locate the predator or their partners.

5. Introduce the stances of predators and prey. The predator faces forward and focuses his whole body on his prey. The prey stands straight at alert and listens all around him. Explain the placement of the eyes - the predator's eyes in front for focusing and the prey's on the side for seeing in all directions.

Closure:

Show a picture or skull of an animal. Ask the students to use what they learned to describe how the animal hunts, whether it is a predator or prey, and give evidence that supports their conclusions.

Extensions:

1. Bring in some skulls and discuss eye placement, and whether predator or prey.

2. Compare and contrast the above information to birds. Most little birds have independent eyes on each side. However, raptors, or hunting birds, such as hawks or owls, have eyes in front to focus on prey.

Predator

Bald Eagle

Striped Skunk

Great Horned Owl

Gray Fox

Prey

Prairie Dog

Gambel's Quail

Cottontail

Gray Squirrel

Red Squirrel

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Horns or Antlers

Objectives:

Students will explain the differences between horns and antlers. Students will explain that all antlers and horns are found only on hooved animals.

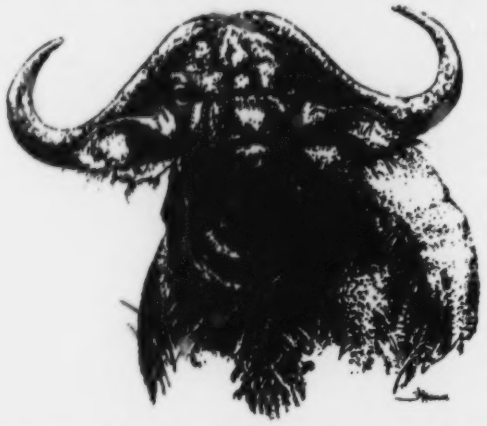
Grade Level: K-6
Materials: Pictures of animals with horns and antlers. If possible, a real horn and antler.
Time required: 30 minutes.
Structure: Teacher-led discussion with class brainstorming. Inside.
Source: TOPS, *To Run or Not To Run,* Learning Systems, Animal Survival.
Skills: Problem solving, critical thinking.

Background:

Most hooved animals have antlers or horns. These have two purposes, primarily for establishment of domination over the herd, but also for protection.

Antlers are found on all males of the deer family and on the female caribou, or reindeer. Antlers are made of bone and fall off and regrow each year. As new antlers grow, a velvet covering of skin and blood vessels covers the bone. By fall the antlers are fully grown and the velvet dries. The animal rub them on trees to rid the antlers of the dried velvet, exposing the bone. During the mating season in the fall the males use their antlers to intimidate other males to prove supremacy. This allows for the strongest male to mate with the females, assuring stronger, healthier young. Most antlers are branching, are larger in mid-life, and smaller with advancing age.

Horns are found on most other hooved animals, such as sheep, goats, antelope,



bison, etc. Horns have a protective sheath, much like our fingernails, over a core of permanent bone. Horns have no velvet, are rarely branching, grow larger with age, and are common in both sexes. The female's horns are smaller than the male's. Battles of males for supremacy are also common with dominant males.

Procedure:

1. Teacher has class brainstorm animals they can think of that have either horns or antlers, and lists these on the board.
2. These lists can be then separated into one for horns and one for antlers, or do so during the brainstorming session.
3. Pictures of members of the deer family, and those of sheep, goats, or other horned animals are shown and discussed.
4. Comparisons are made between horns and antlers using the above information - listing these on the board.

5. If available, children should feel a real horn and real antler, and compare to their fingernails.

6. Have two children stand with their heads butting together and their hands behind their backs. At a given signal they must try to push the other back until he must step back. Relate to males establishing dominance in a herd.

Discussion:

Discuss how having horns on top of an animals head would help protect it. Review how most animals with hooves have either horns or antlers. These are used to establish dominance.

Closure:

Students are able to name a hooved animal and tell whether it has horns or antlers. Students can relate how some animals show their supremacy by butting heads.

Extensions:

Have children play "King of the Hill" in which a person maintains control over a spot. Have two children hold each other's hands and try to push the other back. A worksheet can be provided or they can draw an animal with horns or antlers and tell about it.

Horns

Pronghorn

Bison (Buffalo)

Mountain Goat

Bighorn Sheep

Antlers

Elk

Barren Ground Caribou

Mule Deer

White-tailed Deer

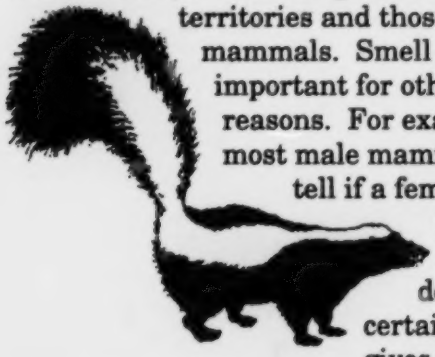
The Nose Knows

Objective:

The student will understand the importance of the sense of smell to animals.

Background:

Smell is the most important sense for most mammals. They use their noses to detect predators or prey, to distinguish between family and non-family members, to find mates, and to recognize their territories and those of other mammals. Smell is also important for other reasons. For example, most male mammals can tell if a female is ready to mate by detecting a certain odor she gives off. Many mammals mark their territories with urine or feces and special scents from anal glands or glands in their feet or other parts of their bodies. Some animals, such as the peccary (javelina) also rub against each other to create a "herd smell". When most mammals meet they identify each other by sniffing.



Deep inside a mammal's nose is an area call the olfactory (ol-FAC-tor-ee) region. The olfactory region has lots of "smelling" nerves. When people or other mammals breathe air through their noses, odors in the air "turn on" these special smelling nerves. Biologists are unsure how the brain identifies the different odors, but they do know that mammals can distinguish among thousands.

Grade Level: K-6
Materials: Empty film containers with cotton balls saturated with different scents.
Time required: 30 minutes.
Structure: Whole group - indoor.
Source: Nature Scope - *Amazing Mammals.*
Skills: Science, social studies.

Procedure:

Activity 1:

1. Soak each cotton ball in a different scent (such as peppermint, lemon, orange, maple, vanilla, vinegar, coconut, root beer, chocolate, or cinnamon) and put each one in a different cannister.

2. Have the students sit in a circle. Pass each container around one at a time.

3. After everyone has had a chance to smell what is in a particular container, talk about what the smell was before passing around the next container.

4. Discuss how mammals are able to identify thousands of smells. Ask what would happen if a wild animal failed to recognize a particular odor (could get killed by a predator, lose a chance to catch a meal, mistake an intruder for a relative, eat food that is rotten, etc.)

Activity 2:

1. Have 3 or 4 containers. Number them on the cover and on the bottom.

2. Pass the containers out to 3 or 4 students. These will be the "female parents". Let the female parents "learn" their smell. Collect the containers. They may keep the covers.

3. Mix up the containers and pass out to 3 or 4 other students. These will be

the "offspring". Have them move to the other side of the room with the containers.

4. The female parents will then try to find their offspring by smelling the containers.

5. Have female parents and offspring check their numbers to see if they are correct.

Discussion:

1. Ask the students how they were able to detect their offspring's smell and how animals use this sense.

2. Ask how animal parents (pairs) in the wild can tell their offspring at a distance.

3. Why is a sense of smell important to both predator and prey?

Closure:

Have students to describe how animals use a sense of smell to identify family members, predators, and prey.

Extensions:

1. Take information about an animal and cut up and place on a series of cards. (One for range, one for description, one for niche, etc.) Glue a cotton ball on each card. Then soak the cotton balls with a smell and put all the cards for one animal in a baggie to absorb the smell. Repeat for other animals.

2. Spread out similar cards in different areas. (All the range cards will go on one table, the description cards on another table, and the niche cards on another.)

3. Divide the class into as many groups as you have animals. Have each group choose one card from the first table and then try to find their next card from the next table, etc. The last table will have the name and picture of the animal.

4. The group must then check if all the cards are related to that animal.

Feet–Feet–Feet

Objective:

The students will explain how the shape of an animal's feet enables it to survive in its habitat.

Background:

An animal's feet help determine how it lives, eats, and protects itself. A hoofed animal walks on its "toes," either on one like a horse, two like a deer, or three like a tapir. Hoofs enable the animal to move faster and cover more territory.

Most predators have paws. The animals in the dog family have pads with four toes with nails which allow them to run fast. The nails help them get traction for speed for coursing. These pads can stretch out to give a larger walking surface, as needed on snow, for instance. Cats also have pads with four toes, but have retractable claws so that the claws can remain sharp for gripping their prey and allow for quiet stalking of animals.

Procedure:

1. Have selected students show how they would run as fast as they could a specified distance (about 30 feet) on flat feet with their heels touching the ground.

2. Ask them to run back using only their toes.

3. Let the rest of the class try the same activity.

22

Grade Level: K-6
Materials: Pictures or models of footprints.
Time required: 30 minutes.
Structure: Whole class discussion.
Source: Lorna Taylor.
Resources: Arizona Game and Fish Skull Kit, Arizona Sonora Desert Museum Predator and Prey Kit.
Skills: Problem solving, information gathering, critical thinking.

4. Have the students try stalking something on flat feet, then on their toes.

5. Bring the class inside, or have them sit as a group for discussion.

Discussion:

1. "Which way could you run the fastest — on your flat feet or on your toes?" Explain how most four-legged mammals run on their toes. Dogs and cats have their fifth toe higher up on their legs. Explain that an animal that runs after their prey is called a "**courser.**" Animals in the dog family fit this category.

2. "Was it easier to stalk silently on flat feet or on your toes?" By walking on the pads less noise is made. Most animals that stalk their prey are in the cat family and are called "**stalkers.**" Let students decide which way they would rather hunt and give the reason why.

3. "When would toenails come in handy?" Talk about predators like the wolf which need traction to run faster. Cats use their nails (claws) for clinging onto their prey.

4. "What are hoofs?" Explain that hoofs are really adapted toes. Hoofs are made of **keratin** - the same material fingernails and horn coverings are made from. Have the students "walk" with the tips of their fingers (4-5 toes-elephant, 3 toes-tapir, 2 toes- deer or cow, 1 toe-horse). Some

fingers became more dominant. Extra unneeded fingers disappeared. The "fingernail" material grew into hoofs. This allows for faster movement, and protection of the bones when running.

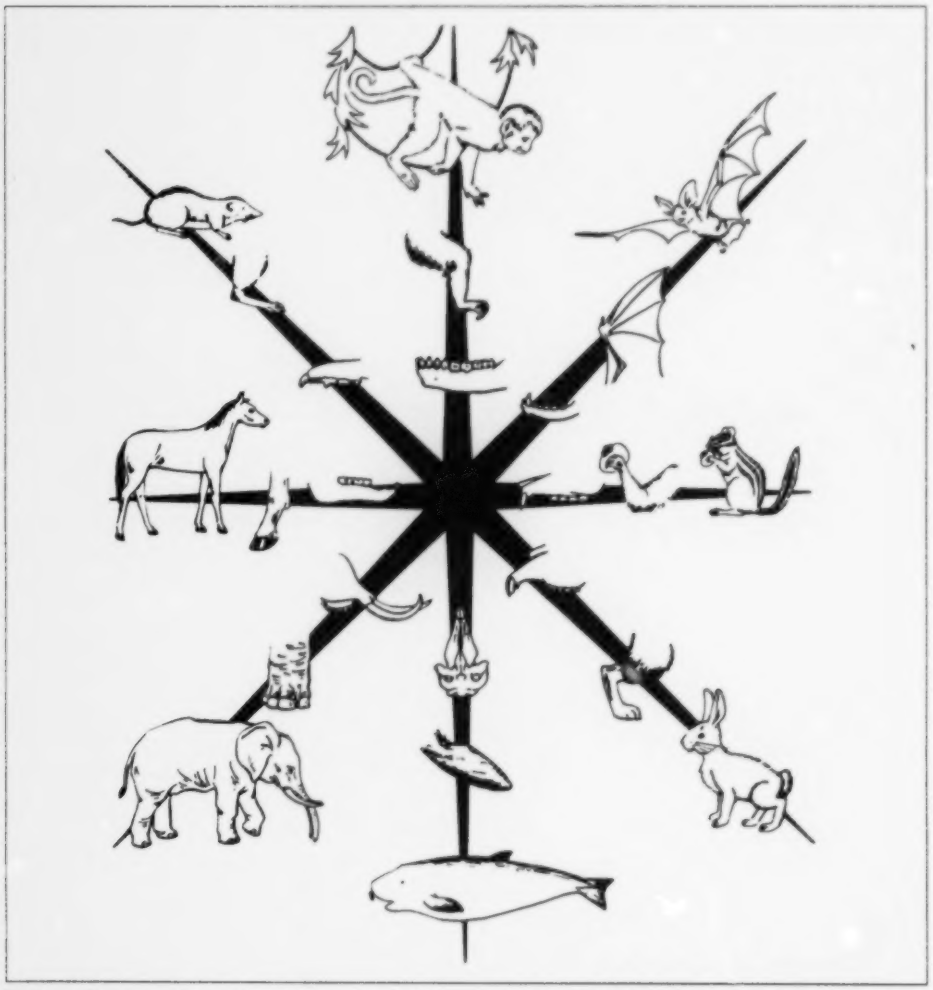
Closure:

Have students explain how an animal's feet enable it to survive. Hoofs are advantageous for swift movement. Paws with nails provide better traction when running or gripping when killing its prey.

Extensions:

1. Give each student an activity sheet and have them describe the mode of movement for each footprint. Ask them to determine the advantage of the shape for the animal.
2. Make model footprints by molding them in clay and pouring in plaster of Paris.
3. Make prints of their own footprints. Ask them to determine the advantage of tennis shoes over high heels, etc.

CLASSIFICATION OF MAMMALS



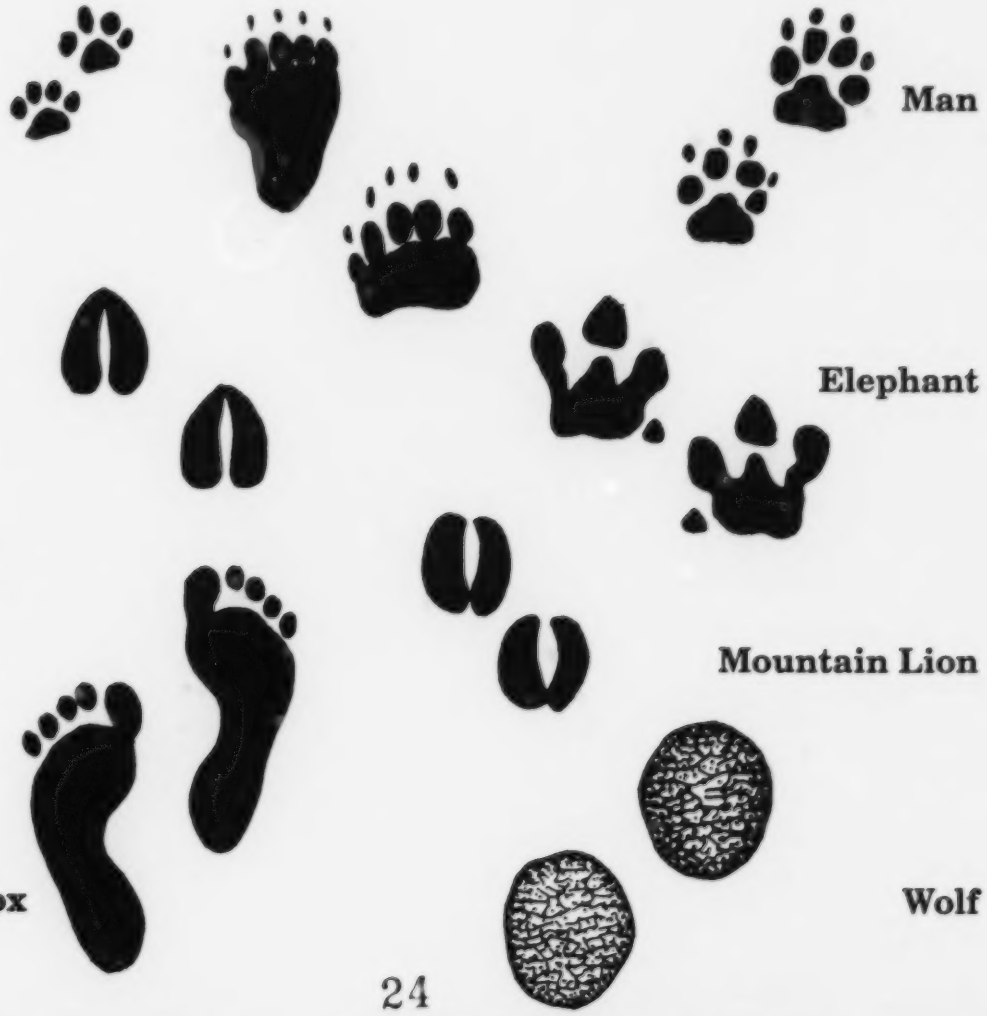
Orders of mammals are based on major differences in limbs, digits, and cranial modifications.

Footprint Detectives

Many animals live in our world. Why don't we see many of them? Some only come out at night. Some live underground or in the water. Others shy away from humans or live in a remote area.

One way to find out what animals live in an area is to look for footprints. Ask yourself questions like: Is the animal big or small? Does it have toes? Does it hop? Does it have claws? Was it moving fast?

Are you a good footprint detective? Can you match these footprints with their owners?



24

Whose Feet?

Ape
Plantigrade

Cat
Digitigrade

Pig
Even-toed Ungulate

Horse
Odd-toed Ungulate

How an animal stands on its feet is an adaptation to the way it lives. The feet of most animals can be compared to our hands. Try holding your hands in these positions and imagine how the different animals walk or run.

Plantigrade	Digitigrade	Even-toed Ungulate	Odd-toed Ungulate
Put your hands flat on the table.	Put four fingers down but lift up the heel of your hand.	Put two middle fingers down and pull other fingers behind, but not touching the table.	Squeeze all four fingers together with just the tallest finger touching the table.

25

How Old Are You?

Objective:

The student will explain that the age of a mammal can be determined by either the size and amount of baby teeth, or by the rings in the adult teeth. The age of birds can be determined by the feathers.

Grade Level: K-6
Materials: Student activity page 74.
Time required: 30 minutes.
Structure: Whole group discussion with followup page.
Source: Wild Times, Vol. 6, No. 3, *Outdoors*, by Wyoming Game and Fish Department.
Skills: Science, social studies, art, thought process.

Background:

All mammals have teeth. When a study is done by biologists, they need to determine the age of the mammals to find out if the herd is growing, stable or diminishing. To tell the age of animals, they can count the baby teeth, or extract a molar and slice it in the lab. The slices will show rings, much like tree rings, which will determine the years an animal has lived. The rings are formed by the poorer food quantity and quality of winter as opposed to summer abundance.

The age of birds is determined by feathers. If the last three long feathers on each wing (known as the primary feathers) are rounded, it is probably an adult. If they are short and pointy, they are probably young. In addition, many immature birds have different colored feathers than the adults.

Procedure:

1. Have the students talk about their own teeth. How old were they when they lost their first teeth? When did they lose their second teeth?

2. Explain that all mammals have baby teeth, and biologists can tell the age of a young animal by the number of baby teeth it still has.

3. Explain that if the animal no longer has any baby teeth, it is considered an adult. In this case, a tooth is extracted, or pulled out, and taken back to the lab. There it is sliced. The slice shows rings in the teeth. Each ring stands for one year, much like the rings in a tree.

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4. Explain that in the wild the amount of food available during the winter is much less and of poorer quality that in the summer. This makes the rings form.

5. Compare and contrast to birds. Birds don't have teeth. Biologists have to look at the feathers. Young birds often have more protective coloration than adults. However, if the bird has the adult coloring, how do bioloists determine age? Explain that the primary wing feathers are rounded in the adults from constant use, while the younger birds have more pointed tips.

Discussion:

1. Ask the students to tell two ways to determine the age of an animal. Review how the baby teeth fall out, and adult teeth take their places. Explain that many mammals, such as puppies, have baby teeth which fall out as they get older. How can adult teeth be aged? (rings)

2. What are the differences between feathers of adult and immature birds?

Closure:

Ask students to explain how young mammals lose their baby teeth much like they do, and that the age can be determined by the amount of baby teeth left. Adult teeth need to be extracted and sliced to determine age. Birds' ages are determined either by the shape of the primary wing feathers or the color.

Extensions:

1. Show a video of a Game and Fish study of an animal where a tooth is being extracted to determine age.

2. Look at a cut of a tree and count the rings. Compare to the teeth of adult animals.

3. Display pictures of birds flying and try to determine whether they are adults.

27

Web of Life

Grade Level: K-6
Materials: Tagboard or construction paper or 3" x 5" cards, large ball of string.
Time required: 30-60 minutes.
Structure: Up to 30 individuals.
Source: Project Learning Tree.
Skills: Problem solving, information gathering, critical thinking.

Objective:

The student will state that all living organisms are interrelated.

Background:

All living things depend on each other in one way or another. These interrelationships can be demonstrated through a food web. The survival of a predator depends on the availability of suitable prey. Prey species are in turn dependent upon smaller prey or plant life for survival.

Procedure:

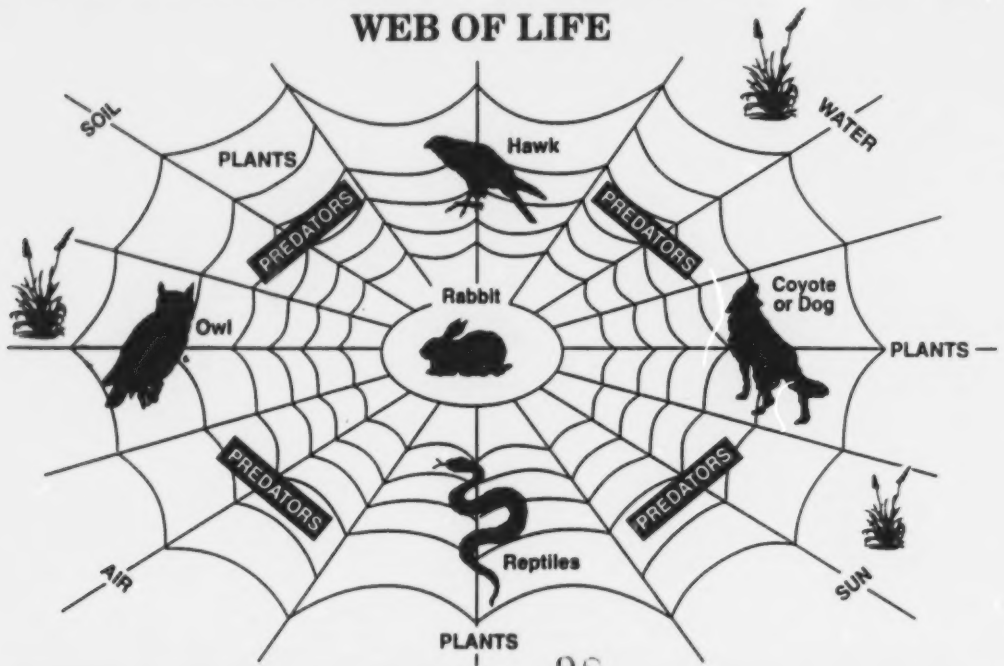
1. Prepare cards or small signs for each of the following: 1 sun, 1 water, 1 air, 1 soil, 10 plant, 10 herbivore, 5 carnivore, and 5 omnivore. Color coding of plant, herbivore, carnivore and omnivore groups makes them easier to distribute. Individual species can also be listed on each card.

2. Have the students sit in a circle. Ask "What is the most important thing for all living things?" Give the student who answers "Sun" that sign.

3. Ask "What else is needed in order for life?" Give signs for water, air and soil to other students quarterly spaced around the circle. Hand the ball of string to the "sun". While hanging on to the end of the ball of string, roll it to the other students with the ball of string finally returning to the "sun".

4. Ask what needs the sun to grow (i.e. grass). Give a plant sign to a student across from the "sun" and have the sun hold onto the string and roll the ball to "grass".

5. Then ask what would eat "grass" (i.e. rabbitt). Give the herbivore card to a student across the circle, have "grass" hold the string and roll the ball to "rabbit".



6. Then ask what would eat the rabbit (i.e. coyote). Give a carnivore card to a student across the circle and have "rabbit" hold the string and roll the ball to the "coyote".

7. Next ask what else the coyote might eat (javelina). Continue to have students hold onto the string and roll the ball of string to a related predator or prey until all students are holding the string and have a card. Have the students pull back on the string until all of the slack is taken up. Then pluck the string to feel the system's "vibrations." Ask what this criss-cross of string resembles. (A web.) Discuss food webs and how things are interrelated.

8. Choose a student whose sign represents a predator. Ask all students who represent animals this predator preys upon to release the tension on the string **but not let go**. Have everyone who feels a difference in the string to raise their free hand.

9. Have students who also prey upon this animal to ease the tension **but not let go**. Ask everyone who feels the difference to raise their free hand.

10. Choose an animal or plant from the signs that is endangered. Have that student drop the string. "What is happening to our web?"

11. Continue until all students have dropped their strings. Try to use a natural progression through one food chain--plant, herbivore, carnivore or omnivore.

Discussion:

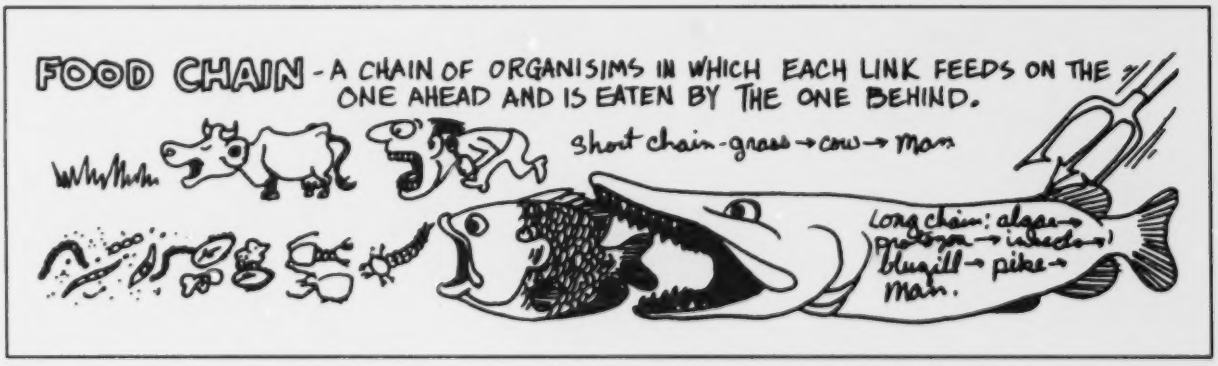
1. How were the plants and animals related?
2. How were the plants and animals affected when strings were dropped?
3. Can the system stand the loss of these dropped strings?
4. How are all living things interrelated?

Closure:

All living things (organisms) are interrelated. The loss of one living thing affects all others in the food web.

Extensions:

1. Develop a mural with plants and animals showing their interrelatedness.
2. Post simple food chains drawn by the students on large butcher paper. Ask students to make connections from their food chains to those drawn by other students, creating a more complex food web.
3. Introduce a system without the diversity. What happens if there is only one plant variety (grass)?
4. Assign students to research and develop food webs of their own needs. Where does the milk, bread, water, etc. that they use everyday come from? What happens if pollution contaminated the water, wheat fields are flooded out, etc.?


FOOD CHAIN - A CHAIN OF ORGANISIMS IN WHICH EACH LINK FEEDS ON THE ONE AHEAD AND IS EATEN BY THE ONE BEHIND.
short chain - grass → cow → man
long chain: algae → protozoa → insects → bluegill → pike → man.

Hairy Mammals

Grade Level: 1-6
Materials: Three blindfolds.
Time required: 30-60 minutes.
Structure: Whole group, outside.
Source: Lorna Taylor and Patricia Regehr.
Skills: Critical thinking, physical education.

Objective:

The student will compare and contrast different kinds of hair and model how these protect an animal.

Background:

All mammals have hair. This hair has a variety of functions. Some is fine and found next to the skin. This provides insulation for cold weather in winter. Some is longer and tends to protect the body from rain. This longer hair can also be raised to make the animal look bigger and intimidating. Whiskers are hairs found on the face and are used for sensing objects. Other hairs, such as the quills of a porcupine, are modified for protection.

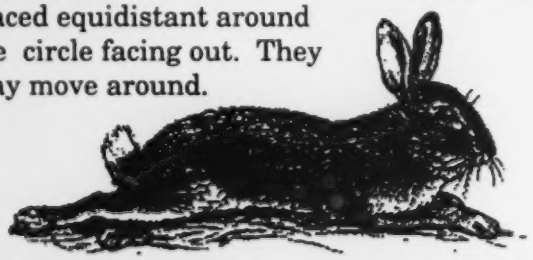
Procedure:

1. Select one student to be an animal, such as a deer.

2. Designate half the class to be "insulating" hair. (Relate to the fuzzy hair a dog has next to his skin in winter, and sheds in summer.) These students will stand shoulder to shoulder in a circle facing out with their backs to the animal chosen in the middle.

3. Assign the remaining half of the class to be "guard" hairs. (Relate to the longer hairs on a dog or cat.) They will stand in a circle in front of the insulating hairs, also facing out with their arms outstretched. They must stay in place, but can move their arms.

4. Choose three students to be "sensing" hairs. (Relate to the whiskers on their dog, cat or hamster.) These are blindfolded and placed equidistant around the circle facing out. They may move around.



5. The rest of the class will be "water" and try to get through to the animal to chill him. They may only walk. Emphasize safety.

6. At a given signal, the water moves into the circle trying to reach the animal. If it is tagged by a guard or sensing hair, it must stay where it is tagged.

Discussion:

Ask students what they learned about hair. Discuss how the guard hairs could protect because they could use their hands, and the insulating hair was so close together that water could not penetrate. The sensing hairs had to feel for water.

Closure:

Have students explain the different adaptations of hair and how they protect a mammal.

Extensions:

1. Ask the students for examples of hairs which are adapted for protection, such as the quills on a porcupine or echidna, or the hollow hairs of a polar bear which are used for insulation.

2. Compare and contrast the adaptations of feathers: **down** as the soft, fuzzy insulating feathers, **contour** as the waterproof body feather, and **primary** being the wing feathers used for flying.

3. Have samples of real fur for students to study. Ask them to describe similarities and differences. Have them predict the type of environment where each might live.

Delicious Diorama

Objectives:

Students will create a diorama representing an animal and its habitat using edible materials.

Background:

Natural history museums utilize dioramas to show animals in their natural surroundings. A diorama is a three-dimensional minature representation of a scene. In this case, the scene is an animal and its habitat. The habitat must include plants and other animals that are native to the area. It must provide for the animals' need for suitable shelter, food and adequate water supplies.

Grade Level: 1-8
Materials: 1 dirt pie per group:
- 1 C. cold milk
- 1 package (4-servings) chocolate pudding
- 3 1/2 C. (8 oz.) thawed whipped topping
- 20 chocolate sandwich cookies, crushed
- 1 1/2 C. "Rocks" made of granola chunks, chocolate chips, peanut butter chips, chopped peanuts, or a combination.
- Caramels
- 1 package graham cracker pie crust
- Additional materials brainstormed by students
- Measuring cup

Time required: Two 1/2 hour sessions.
Structure: Groups of 4-6.
Source: Patricia Regehr
Skills: Art, problem solving, research, creative thinking.

Procedure:

1. Each group will choose an animal and discuss its habitat (where the animal lives).
2. Discuss what a diorama is. Tell the students they will make an edible diorama. Ask students to suggest what things could be used to make grass, rocks, etc.
3. Begin by making a "dirt" pie:

A. Pour milk into medium bowl, add pudding mix, and beat with wire whisk until well-blended 1 to 2 minutes. Let stand 5 minutes.

B. Fold in whipped topping. Stir in 1 cup of the cookies and the "rocks" to make picture mixture. Spoon into pie crust.

C. Sprinkle with remaining cookies. Freeze until firm, about 4 hours. Garnish (rocks - granola, chocolate chips; flowers - gumdrops; grass - coconut dyed with green food color; trees - broccoli; eggs - jelly beans.) Animals can be made of caramels, or colored cut-outs.

Discussion:

1. Ask the students what they learned about animals from the activity.
2. What other things could be used to represent habitat or animals?

Closure:

1. Have students compare and contrast each other's dioramas.
2. Ask them to evaluate the accuracy of each representation of an animal's habitat.
3. Ask each group to identify their animal's food, shelter, and water.

Extension:

1. Make a diorama showing a habitat from a shoe box and paper cutouts.
2. Have children try making a different diorama from edibles at home.

Skull-king

Objectives:

The student will infer from a skull what classification and niche the animal inhabits.

Background:

The physical characteristics of an animal's skull are clues to how the animal adapted to its environment and what niche it inhabits in its habitat. Teeth, eye position, size and shape can indicate whether the animal is a carnivore, herbivore, or omnivore. These characteristics can also tell whether the animal is a predator or prey and if it is nocturnal (night hunter,) diurnal (day hunter,) or crepuscular (dawn or dusk.)

Physical characteristics are as follows:

TEETH

Carnivore: Sharp, pointed teeth suitable for tearing flesh. Long thin canines on upper and lower jaw. Small incisors. Jaw that moves up and down.

Herbivore: Flat, smooth surface on molars for chewing. Jaw moves sideways. May have no incisors or have them on one or both jaws. Canines lacking.

Omnivore: Combination of flat smooth teeth for chewing vegetation, large incisors for biting, pointed canines on upper and lower jaw.

EYE SOCKETS

Predator: Eyes high on skull facing forward, focusing on prey.

Prey: Eyes lower and on sides of skull in order to look in all directions.

Size: Eyes small for diurnal animals; large for nocturnal or crepuscular animals.

Grade Level: 2-8
Materials: A variety of skulls.
Time required: 40 minutes.
Structure: Teacher led discussion.
Resources: Arizona Game & Fish Skull Kit or Arizona Sonora Desert Museum Predator-Prey Kit.
Source: Adapted from Skull Lab (ASDM) by Lorna Taylor and Jean Contreras.
Skills: Science, problem solving.

NASAL CAVITY

The larger the nasal cavity, the more important the sense of smell.

EAR POCKETS

The larger the ear pockets, the better the sense of hearing and the better balance the animal has.

Procedure:

1. Tell students they are going to gather evidence regarding an unknown animal. They are not allowed to guess what the animal is until they have all the evidence.
2. Create a chart on the board or provide students with a blank chart with the following headings: skull number, eyes, teeth, jaw, food (carnivore, etc.) size and shape, niche (predator/prey), family, name.
3. Show a skull. Ask which way the animal appears to be looking. A pencil in the eye socket will help tell this. Have students determine relative size. Record this information on chart.
4. Work the jaw and show the teeth. Ask students to describe the kinds of teeth and how the jaw works. Record this information.

5. Hold the skull above the table with one hand and use the other to help the students visualize the height and length of the animal. Suggest words to describe the size and shape.

Discussion:

1. "From the information on the chart, what food would this animal eat? If it is equipped to eat meat, what else do you know?" (It is a carnivore and its niche is predator.) Do this for each skull.

2. "If a skull has large eye sockets and large ear pockets, flat gnawing teeth, and small size brain capacity, what else can be inferred?" (It is a herbivore, has good hearing for listening for predators, and is probably nocturnal.) Do this for all the skulls.

3. Have students infer family and name of each skull.

Closure:

1. Have the students state what most important characteristics of the skull were needed in order to identify the skull. (Kind of teeth, size and direction of eye sockets, jaw movement, size and shape of skull, etc.)

2. Explain that these characteristics are the basis for the science of taxonomy.

Extensions:

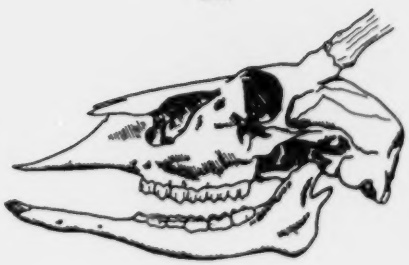
1. Design an animal. Decide on the size and direction of the eyes (nocturnal or diurnal,) nose, ears, fur color, legs, feet, etc. Draw or create a model of the animal. Present the animal's characteristics to a partner or the class.

2. Write a description of an animal. Be sure to include all the important information learned in this activity. Give to another student to infer what the animal is. Be sure to use references in order to have correct information.

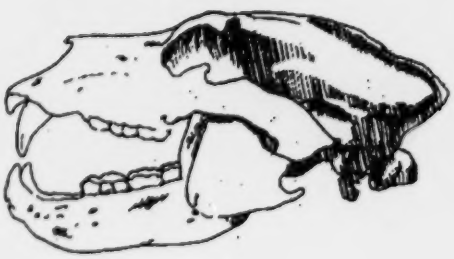
TYPES OF SKULLS

Mountain Lion

Elk



Bear



Leaky Beaks

Grade Level: 3-6
Materials: Plastic bags, assorted beaks (scissors, tweezers, tongs, spoons, nets), beans, tooth picks, packing "popcorn", marbles, "pond" (child's wading pool or dishpan), paper towels, lab sheet, pencil.
Time required: 30-40 minutes.
Structure: Whole group, inside or outside.
Resource: Ranger Rick's NatureScope, *Birds*, National Wildlife Federation, 1412 16th St. N.W. Washington, D.C. 20036-2266. National Audubon Society.

Objectives:

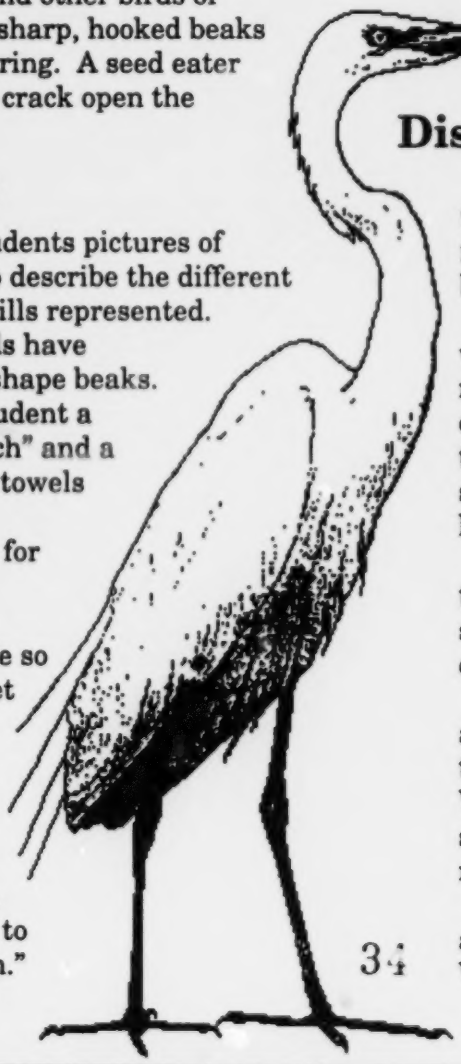
The student will analyze data to infer that bird adaptations (beak shape, size, etc.) are related to the kind of food they eat.

Background:

Birds have an incredible variety of beak shapes, feet, and body shape and size. Many of these adaptations help the birds to utilize specific food sources. Wading birds have long slender legs, long thin toes, and long beaks which may be pointed or shaped like sieves. Hummingbirds have long thin bills, or beaks, for dipping into flowers. Eagles, and other birds of prey, need strong, sharp, hooked beaks for ripping and tearing. A seed eater needs to be able to crack open the shells of its food.

Procedure:

1. Show the students pictures of birds. Ask them to describe the different kinds of beaks or bills represented. Ask them why birds have different size and shape beaks.
2. Give each student a plastic bag "stomach" and a "bill." Have paper towels ready.
3. Have a pond for each group of 5-6 students or set up wading pool outside so whole group can get around it.
4. Show them each kind of food and how to use their beak to pick up food. Tell them to use their "beak" to "feed their stomach." Then place food in "pond".
5. When food is gone from pond, have students empty stomach on paper towel and separate food into separate piles.
6. Have them count and record on the towel the amount of each kind.



Discussion:

1. On board make a chart. Across the top list the different kinds of food. Down the side list the kinds of beaks.
2. As each child reports, he/she will tell what kind of beak, and the number of each kind of food collected. Keep a running total on the chart. Encourage the other students to assist by adding in their heads.
3. Once the chart is complete, ask the students which kinds of beaks seemed better adapted for collecting each food.
4. If some foods are only available part of the year, how will that affect the bird who specializes? Which birds would be most successful in finding food year-round?
5. Which beaks were better adapted for floating or sinking food? Which would be better in the mud?

Closure:

1. Have students tell what they learned. Birds whose beaks allow them to utilize a wider variety of foods seem better adapted for survival.

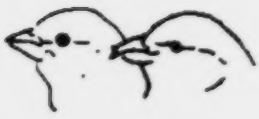
2. Birds whose diet consists of only one or two types of food must find other ways to survive if their food disappears, as in winter. (Migration)

Extension:

1. Graph the results of each kind of food.

2. Find out which water birds live in local area. Have the students infer food each would eat from their beak shapes

3. Find out which birds migrate in your area and why.



SEED-EATING. (a) Short, thick bill for crushing seeds. Examples: sparrow, grosbeak, bunting, finch. (b) Upper and lower mandibles crossed to enable bird to extract seed from cones of evergreen trees. Example: crossbill.

INSECT-EATING. (a) Slender, pointed beak for picking up insects. Examples: warbler, vireo, (b) Very wide mouth for catching insects on the wing. Examples: swallow, nighthawk, swift.

PROBING. (a) Long, slender bill for probing in mud in search of food. Examples: snipe, woodcock, other sandpipers. (b) Long, slender bill for probing the necks of flowers to feed on nectar. Example: hummingbird.

PREYING. Strong, sharp, hooked bill for tearing flesh of prey. Examples: owl, hawk, falcon.

STRAINING. Broad, flattened bill for straining food from mud. Examples: flamingo, duck, goose.

GROUND-FEEDING. Short, stout bill for feeding on the ground. Example: bobwhite.

FISH-EATING. (a) Long and sharp for spearing fish. Example: heron.

(b) With a flexible pouch underneath for holding captured fish. Example: pelican.

Animal Adaptation

Objectives:

The student will identify adaptations made to differences in environment.

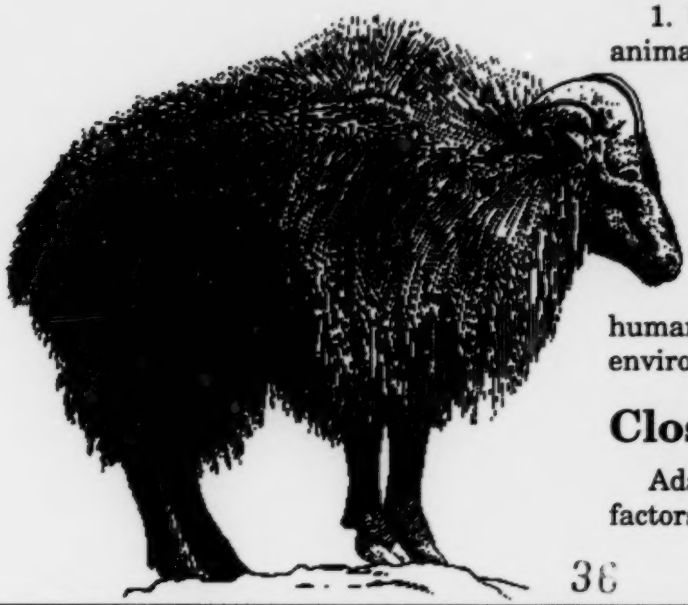
Background:

Animals of the same species have adapted to differing environments by gaining specific characteristics that help them survive. Adaptations can affect fur, feet, tail, etc. For instance, a polar bear has hollow hairs which provide insulation and black skin to absorb the sun's heat.

Grade Level: 3-12
Materials: Wildlife museum, collection of mounted animals.
Time required: 30-60 minutes.
Structure: Up to 30 individuals. Divide into teams of no more than 3 if necessary.
Resources: Project WILD: *What Bear Goes Here; Seeing is Believing.*
Source: Lorna Taylor, Patricia Regehr.
Skills: Problem solving, information gathering, critical thinking.

Procedure:

1. Give students a brief introduction about different environments.
2. Brainstorm what kind of adaptations would be helpful for survival in different environments.
3. Divide into teams and give each team one of the following animals to research throughout the museum.
   - A. Bear (black, grizzly, brown, polar)
   - B. Lion (African, cougar, sabertooth)
   - C. Antelope (any of the African varieties and the pronghorn)
   - D. Buffalo (bison and cape)
   - E. Sheep or goats (all varieties)
   - F. Deer (white-tailed, mule, African varieties)
   - G. Large ungulates (elk, moose, caribou)
4. Each team should look for similarities in the animals they are assigned, but especially look for differences that would help them adapt to their particular environment. Differences could be in fur, color, horns/antlers, claws, hoofs,tails, etc.
5. Award points for the number of differences found by each team.



Discussion:

1. How does each adaptation help the animal survive?
2. What similarities and differences in characteristics do these animals display?
3. Would the animals be able to adapt if the environment changed rapidly?
4. What has made it possible for humans to populate virtually every environment on earth?

Closure:

Adaptations are responses to limiting factors in the environment.

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Silly Silhouettes

Objectives:

The student will list the attributes of different silhouettes.

The student will describe an animal by its attributes or characteristics.

Background:

The science of classifying animals and plants according to natural relationships is called Taxonomy. A tree could be used to illustrate the diversity of wildlife with each branch indicating a different group (order) of animals. Orders are defined by variations in taxonomic characteristics such as: limbs (modifications for flying, running aquatic life, etc.,) digits (reductions and modifications), nature of the end of digits (nails, claws, hoofs), dentition (presence or absence of canines, molars and premolars), as well as characteristics of soft anatomy. Animals are grouped by descriptions of their characteristics. An animal can also be identified by its characteristics. Descriptions must be complete in order to correctly place an animal in the taxonomy.

Procedure:

1. Give each group a stack of cards which have one silhouette each on them.
2. Have each student draw a card and list as many characteristics as possible in five minutes.
3. Students must put cards back in pile. Pile is shuffled and all cards are turned right side up.
4. Students will pass their list of attributes or characteristics to student the right.
5. Students must match the new list to a silhouette.

Grade Level: 3 to adult.
Materials: Animal silhouette cards, family (optional). Tree of Mammals is Activity Sheet.
Time required: 30-40 minutes
Structure: Groups of 3-5.
Resources: See also "Mammal Mania ."
Source: Jean Fields, Jean Contreras.
Skills: Organization, classification.

Discussion:

1. Which list had the most attributes?
2. Did the number of attributes listed make it easier or harder to match?
3. Would you write your lists differently if you were to do this a second time? Why?
4. Have students give suggestions on writing better descriptions.

Closure:

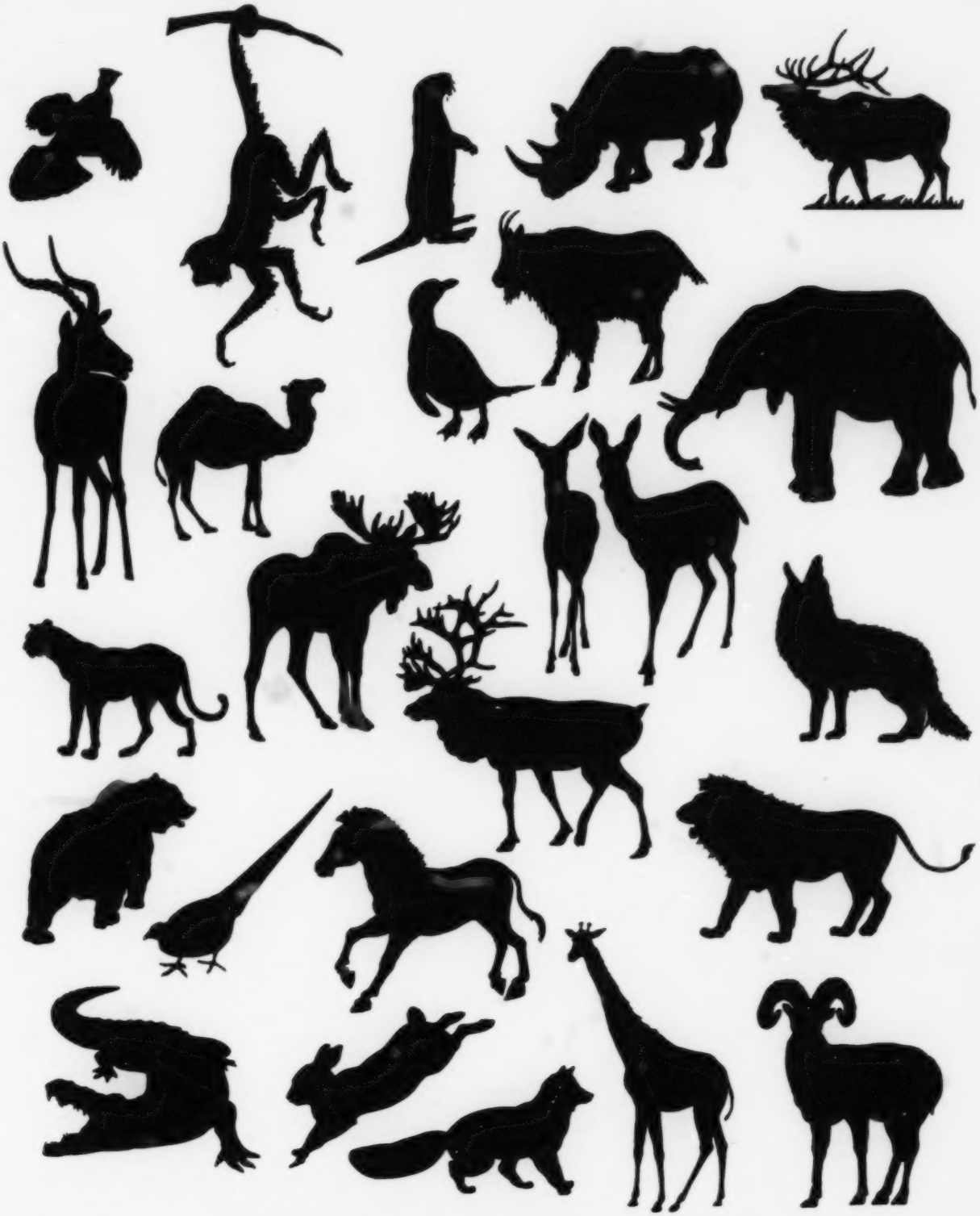
Even within one species there can be characteristics or attributes which separate them from other members of the same species. Scientists need to be good observers and recorders of these differences.

Extension:

1. Have students select a second card and see how many different attributes they can observe and record.
2. Play "Silhouette Slap." Each group deals out all the cards. Students pile cards face down in front of them.

Teacher calls out an attribute (short legs.) Student whose card has the short legs slaps his/her card and sets it aside. If the card does not have it, the card is returned to the bottom of the deck. Play continues until all cards are gone.

Silly Silhouettes



Habitat Rap

Objectives:

The student will learn about the interrelationships and interdependencies of animals and plants in their natural environment.

The student will commmunicate knowledge of interrelationships by writing and performing a "rap" verse.

Background:

All animals need food, water, shelter or cover and space in order to survive. The area where an animal finds all of these resources is its habitat. There can be a wide variety of habitats within an environment. Not all animals use the same kind of habitat. For example, birds may use trees for perching, feeding and nesting, while deer use open grasslands in the same area for browsing.

Procedure:

1. Divide class into 6 groups.
2. Give each student a copy of the Habitat Rap. Assign each group a verse.
3. Have each group practice reading their verse and the chorus.
4. Lead total group in performing the Habitat Rap. Everyone reads the chorus.

Grade Level: 3 to adult
Materials: Copies of Habitat Rap.
Time required: Variable.
Structure: Group choral reading.
Resources: Puppets can be purchased from Country Critters, 217 Neosho, Burlingham, KS 66839.
Source: Adapted from Habitat Shuffle, Indiana University, Recreation and Park Administration Department, Dr. Thomas J. Rillo.
Skills: Language arts, science.

5. Have each group make up their own verse for an animal, plant, or anything required in a habitat. The verse must be factual. Encourage research.
6. Each group now has two verses to perform. The one assigned and their original verse.

Closure:

Each group will perform their verses.

Extension:

1. Habitat Rap can be performed for other classes, PTA, etc..
2. Puppets can be used to dramatize the rap.

Habitat Rap

CHORUS:

We are the world's nature crew, checking it out, doing it for you...

We're so bad, we know we're good, living in the field, river and wood.

You know that we're not doing for fun, we do it for nature and everyone.

Now we're not here looking for laughs, we're just here to do the habitat rap.

VERSES:

EAGLE:

They call me eagle, I like to fly, high over the trees, right through the sky,

I'm a predator looking for prey, I live in the trees and hunt all day.

Now I'm protected, my numbers are growing, only because the people are knowing.

But I'm not here looking for laughs, I'm just here to do the habitat rap.

RATTLESNAKE:

Now I'm a rattler, a poisonous snake, if you come upon me I'll make you shake...

I'll mind my own business if you leave me alone, but I'm out to get you if you walk on my home.

I eat the creatures that pass on by, my venom kills and that's no lie.

But I'm not here looking for laughs, I'm just here to do the habitat rap.

BEAVER:

I'm a beaver, I'm pretty okay, I work all night and I sleep all day...

I chop down trees using feet and teeth, my dams and lodges look pretty neat. I live by the water eating on bark, if you disturb me my tail will spark.

But I'm not here looking for laughs, I'm just here to do the habitat rap.

TOAD:

I'll give you a hint, I'm green and bumpy, I move pretty quick, I'm kind of jumpy...

I eat mosquitos and bugs and flies, I've got a loud voice and two big eyes.

Now don't confuse me with Mr. Frog, cause I'm a toad and cool, that's all.

But I'm not here looking for laughs, I'm just here to do the habitat rap.

FIELD MOUSE:

Well, I'm a rodent, they call me mouse, and any old crevice can be my house.

I'm always hunted by predator dudes, I guess I'm a tasty morsel of food.

I run around with my tail and ears, freezing when predators seem to be near.

But I'm not here looking for laughs, I'm just here to do the habitat rap.

SQUIRREL:

Well, I'm a squirrel and I live in a tree, my brother, my father, my mama and me...

All summer long we gather our nuts, then when winter comes we fill our guts.

I like to build my nest in a tall oak tree, to keep predators away from my family and me.

But I'm not here looking for laughs, I'm just here to do the habitat rap.

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Home, Sweet Home

Objectives:

The student will build a bear den based on the average size of black bears' dens in Arizona.

Grade Level: 4-6
Materials; Masking tape, meter sticks, newspaper, garbage bags, card table, chairs, calculators (optional.)
Time required: 1-2 class sessions.
Structure: Whole group.
Source: Ralph Siedel, Mary Dill School
Resources: Al LeCount, *Black Bear Denning in Arizona*, Arizona Game & Fish. See also Project WILD (Extension.)
Skills: Art, geography, language arts, math, science.

Background:

Black bears are the only bears indigenous to Arizona. The last grizzly, or brown bear, was taken in the late 1930's. Arizona Game and Fish Department black bear biologist, Al LeCount, studied the black bear for 10 years and collected data on all aspects of its natural history.

One aspect of the data included statistics on their denning sites. Black bears den in a variety of natural sites such as hollow logs, tree cavities, holes dug into hillsides or under rocks, or under the base of stumps, trees or logs. They may even exploit man-made structures such as drainage culverts, and basements or foundations of buildings. In some cases they have even been found in unsheltered depressions or brushy areas.

Larger entrances allow more heat loss than smaller, more compact dens. Adult males have to compensate for the heat loss by building deeper dens. All dens, except those in rockslides, have entrances concealed by dense vegetation.

Most bears construct nests within their dens unless forced to move to a second den after being disturbed by humans. Nests are constructed of vegetation (leaves, sticks, and grass) found near the den.

Procedure:

1. Due to size and amount of material it is best to build one den per class. Give students the raw data from the chart. Have them find the average for each column. Tape the dimensions on the floor with masking tape.

2. Set up a card table on chairs at the appropriate height for the cavity. Turn chairs with their backs inward to form the tunnel. Have students line the entrance, tunnel, and cavity with cardboard, styrofoam sheets, or any other material.

3. Use metric measuring sticks to double-check accuracy. Have students fill garbage bags with crumbled newspapers and tie off to resemble rocks piled on and around the den. (Reassure your custodian that you will return the bags in good shape so he/she can recycle them.)

4. Have students accumulate nesting material and build nest to appropriate depth.

5. A computer can be used to create signage for the various parts of the den.

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Discussion:

1. Why does the bear need a den in winter? (There is not enough food, so it must live off its accumulated fat reserves.)
2. What difference does the size of the entrance make? (The larger the entrance, the more heat that is lost.)
3. Why would the bear want a nest inside? (Increased insulation, comfort, etc.)
4. What happens to the bear when it goes into hibernation? (Most of its bodily functions shut down. Waste material is recycled.)

Closure:

Bears have adapted to a food shortage by hibernating. They provide for themselves a shelter that will provide safety and warmth during the long winter months. Not all dens are the same size, but all dens have similar characteristics.

Extension:

1. Have students research black bears for their color, diet, place in the food chain, etc.
2. Invite other classes in to tour the den. Have students set up centers where they can give reports as bear biologists on the natural history of this animal.
3. See also "Three Bears Tale."
4. Have all students make a drawing of the interior of the den with the appropriate measurements added.
5. Have students write "Bear Facts" for a trivia game.
6. Use Project Wild activities such as "Which Bear Goes Where?" and "How Many Bears Can Live In This forest?"

	Entrance		Tunnel			Cavity			Nest			
Age and sex (%)	Height	Width	Height	Width	Length	Height	Width	Length	Length	Width	Depth	Depth of bedding*
Adult Males (20)	56	97	46	76	234	61	104	211	99	86	28	13
Subadult males (5)	46	48	41	51	97	94	99	122	71	76	15	
Adult females (nonpregnant) (10)	41	58	41	58	86	64	89	119	76	76	20	10
Adult females (pregnant) (8)	33	66	43	48	76	56	112	149	74	66	20	13
Subadult female (1)	36	30	51	30	81	106	61	116	102	61	20	

* *Not measured for subadults.*

Mean dimensions (in cm) of 44 black bear dens in the four Peaks study area, Arizona.

Caribou Crossings

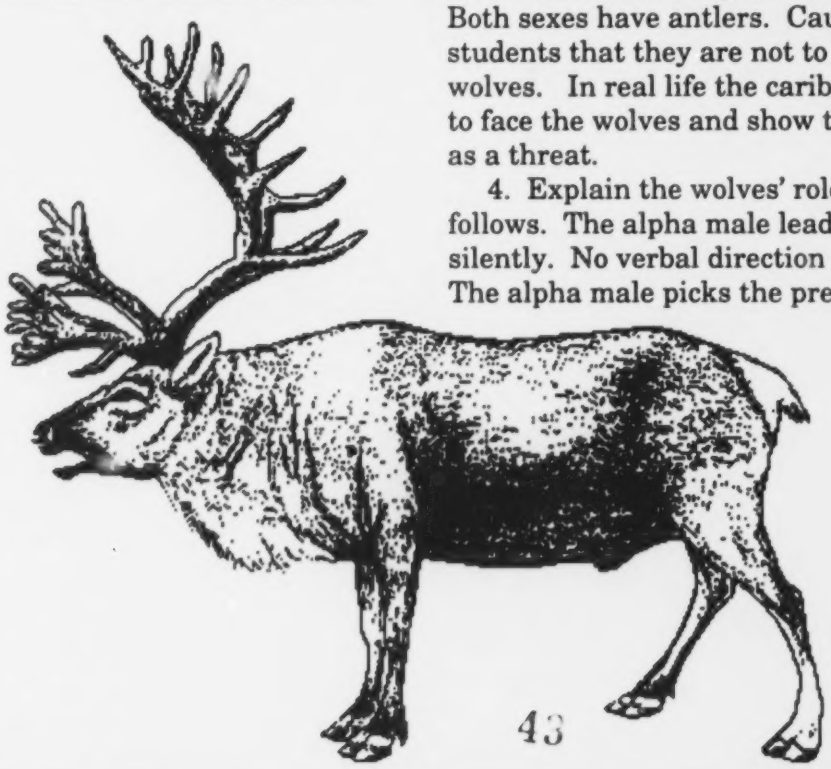
Objectives:

The student will explain the role of wolves as predators and the reason wolves use coursing as a method of hunting.

Background:

Every year great caribou herds travel north of the Arctic Circle to calve. Within these herds are the old, the weak, the sick, and the young that were born too early. The herds are constantly moving. The wolf packs have territories through which these herds move. The wolf has strong legs and abilities which allow it to travel great distances.

The pack is structured in such a way that one male (the alpha male) leads the pack into the herds and selects one caribou for the kill. The pack works together to bring down the prey. The pack then gorges itself on the meat. Upon returning to the den and the young, the meat is disgorged and shared.



Grade Level: 4-6
Materials: A whistle, pictures of wolves and/or caribou, student activity page "Made to Order," Page 69.
Time required: 40 minutes.
Structure: Whole group simulation.
Resources: Wolf Packet, see extension.
Source: Jean Contreras.
Skills: Science, social studies.

Procedure:

1. Give the students the background on caribou and wolves. Explain the term "coursing" as the method wolves use to bring down their prey.

2. Assign two males as the alpha and beta male wolves, and two female students as the alpha and beta female wolves.

3. Explain the roles of the rest of the group as a herd of caribou passing through the pack's territory on its migration north. Strong healthy male and female caribou have some defense against the wolves. Both sexes have antlers. Caution the students that they are not to "attack" the wolves. In real life the caribou would turn to face the wolves and show their antlers as a threat.

4. Explain the wolves' role as follows. The alpha male leads the pack silently. No verbal direction is to be given. The alpha male picks the prey and leads

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the pack into the herd, "coursing" after the selected animal. When the pack has surrounded the prey, the teacher will blow the whistle. This signals a successful hunt. The hunt should go on no longer than three minutes. After that, the teacher should blow the whistle twice to signal an unsuccessful hunt.

5. Change wolf packs after every couple of hunts. Add a crippled, injured or sick caribou.

Discussion:

1. Settle group down in an area where everyone can talk easily. Ask what they learned from their experiences.

2. Ask if the wolf pack posed a major or minor threat to the herd. How many caribou might be affected by each hunt? What would a mother cow do if the wolves attacked her calf?

3. Ask if they changed their techniques after their first hunts. Why?

Closure:

1. Sum up student comments into generalizations such as: Wolves must cooperate within the pack in order to be successful. Wolves do not always make a kill. They cannot wipe out a complete herd. Coursing is hunting by running with the prey.

2. Have students explain the role of wolf as a predator.

Extension:

1. Ask students to compare and contrast coursing with stalking (stalking example: African lions).

2. Have students further research the wolf family structure. A wolf packet can be obtained from the Arizona Game and Fish Department.

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Discovering Wildlife

Objectives:

The student will organize information about unfamiliar animals and infer other information.

Background:

Classifying or organizing animal species into families, classes, etc. is based on details about the animal's structure and the function of those structures. The biologist is able to make certain inferences about animals based on information gathered about newly found species. Further genetic testing may bear out those assumptions or falsify them.

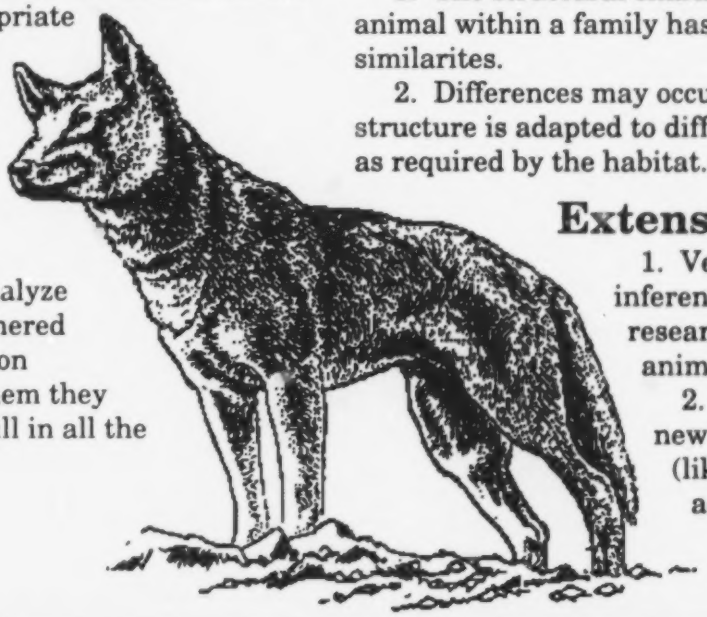
Procedure:

1. Tell the students that they are going to organize information on the student activity sheet brought by field biologists regarding five newly discovered species. They are to organize the clues found in the reports and fill in the missing details by inferring information based on their knowledge of other species.

2. Start them off by having them skim through the clues to find five animal names and fill in the appropriate column.

3. The next step is to begin with the first sentence and pull any details that they can plug into the matrix.

4. Have them analyze the information gathered and infer any addition information. Tell them they may not be able to fill in all the spaces.



Grade Level: 4-6
Materials: student activity sheet, pictures of a margay, dingo, ibex, okapi, and sloth (if possible.)
Time required: 30-40 minutes.
Structure: Individual or group.
Source: Jean Contreras.
Skills: Problem solving, science.

Discussion:

1. Have the students compare the data they organized for similarities and differences. Some students might have more background with these animals than others.

2. Ask them what information allowed them to make inferences.

3. Show a picture of one of the animals and ask them to identify it. Ask to explain how they made the inferences (structure vs. function.)

4. Continue with each animal. Introduce the idea of "process of elimination" as a strategy.

Closure:

1. The structural characteristics of an animal within a family has certain similarites.

2. Differences may occur when structure is adapted to different functions as required by the habitat.

Extension:

1. Verify the inferences by researching the actual animal.

2. Try to build a new logic puzzle (like the student activity sheet.)

Discovering Wildlife

Directions: Read the clues regarding five newly discovered species. Use the chart below to organize this information in a more meaningful way. Start by finding the five animal names and filling in first column. Some spaces can be filled with information that you infer. Some spaces you may not be able to fill.

CLUES

1. The margay can be found in the jungles of the Western Hemisphere where it preys on small animals.
2. Australian dingos don't bark.
3. Both the one from Australia and South America walk on their toes: only one has retractible claws.
4. The dog is from an island continent.
5. European goats live high in the Pyrenees Mountains.
6. Unlike its cousin, the giraffe, this African one is seldom seen on the plains.
7. Hunters search the high mountains for the ibex with the best horns.
8. The bear uses its feet to climb trees in the Asian jungles.
9. The short-necked okapi is a very shy browser of the grassland.
10. The sloth moves so very slowly through the trees that its hair grows green with mold.

Animal	Family	Continent	Food	Feet	Habitat

Elephant Countdown

Objectives:

The student will estimate the number of animals in a population.

Background:

Elephant herds are composed mainly of cows and the young with the matriarch elephant as leader. During wet seasons the groups are large. During dry seasons the groups separate. Bulls form small groups, but individuals will wander in and out of other groups seeking receptive females to breed. Elephants can travel great distances in a short time.

Wildlife biologists must keep track of each population of elephants. If too many elephants are allowed to stay in one area, they destroy the habitat, literally eating themselves out of a home.

Poachers take a tremendous toll on elephant populations. Ivory still commands high prices in many countries. Without careful monitoring and protection, soon there will be no elephants.

Procedure:

1. Have students imagine that they have been hired as biologists in an elephant preserve. Have them brainstorm what problems they would have in getting an accurate count of the elephant population in the preserve.

2. Tell the students that they are going to use one method a biologist might use to get an estimate of the population. This method is done by taking a survey of ample areas.

Grade Level: 4-6
Materials: For each group-one grid with 9-12 squares 3"x3", a bag of 100 beans, individual student activity sheets.
Time required: 40-50 minutes.
Structure: Groups of 4-5.
Source: Jean Contreras.
Skills: Math, problem solving, science.

3. Have the students spread beans (elephants) on grid. Beans are not to be "herded" into groups. Elephants can not be herded either!

4. Follow steps as per student activity sheet.

Discussion:

1. What else could we have done instead of eliminating the high and low estimate? (taken an average of the estimates.)

2. What are some of the advantages or disadvantages of this method?

Closure:

After comparing your estimate to the actual total, decide whether your answer was close enough to be useful in making decisions about the welfare of the elephants in your preserve.

Use each group's data as a different year. Combine to form a data chart over several years. Have students infer whether the population is healthy or endangered.

Extension:

1. Have students find and read charts relating to an animal population, as in endangered species materials.

2. Have students transfer data from charts into graphs which show population trends over time.

3. Have students propose explanations for population increases, explosions, and decreases. Have them make management decisions that will impact on the animal population in their preserve.

Elephant Countdown

Directions: Spread beans (elephants) evenly over grid squares. Elephants on a line may be counted in either square. Do not rearrange them!

PART A: COLLECT DATA

1. Select any 3 squares on the grid. A square may be used by more than one biologist. Count and record the number of elephants in each selected square.

Square 1: _____

Square 2: _____

Square 3: _____

Total: _____

2. Divide the sum from #1 by 3.

Record the dividend here: _____
Ignore any remainder.

3. Multiply the dividend from #3 by the total number of squares on the grid.

Record the product here: _____

4. List all the estimates in your group. Cross out the highest and lowest estimates.

_____

_____

_____

PART B: ANALYZE

1. Which of the numbers in #4 seems to be the right answer?_____
2. Count the actual number of beans and record here._____
3. Was your estimate close?_____ How close? _____
4. Was your group's estimate close?_____ How close?_____
5. What could your group have done instead of throwing out the high and low estimate?_____

PART C: CONCLUSION

1. How do biologists find the total population of animal groups in a given area? _____
2. What are the advantages or disadvantages of this method?_____

_____

Lion Hunt

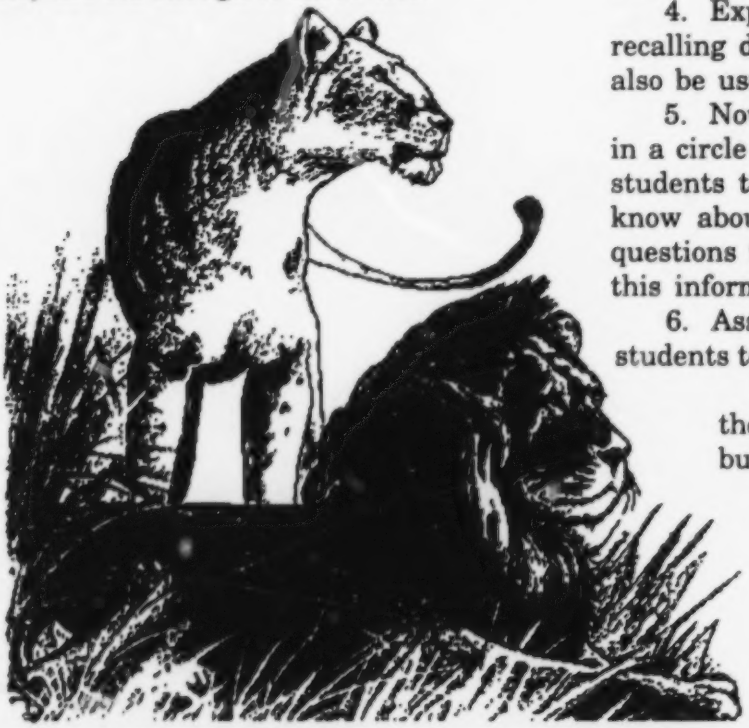
Objectives:

The student will compare and contrast the hunting techniques and family structure of two different species of lion (African and American mountain.)

Background:

African lions live and hunt in family units called prides. The female lionesses lead the pride on the hunt. The females usually do the killing. The whole pride feeds together on the kill. Cubs must compete with adults for their share of the meat.

American mountain lions do not form the same kind of family units. The male is solitary and hunts alone, and is seen with females only during breeding. The female has her young in a secluded spot to keep them safe from predators, which can include the male lion. She hunts alone and brings food back to feed her young until they are old enough to follow her.



Grade Level: 4-6
Materials: Lion Hunt student activity sheet.
Time required: 40 -60 minutes
Structure: Whole group reading lesson, individual research.
Resources: Encyclopedia, wildlife books.
Skills: Language arts, science, social studies.

Procedure

1. Hand out copies of reading comprehension activity sheet (Lion Hunt.) Ask them to read it and turn it over.

2. Write the words Lion Hunt in the middle of the blackboard and encircle it. Have the students give you details or ideas they remember from their reading. Organize this information by drawing lines from the circle and in a wheel-like fashion. Add their information on these lines. Create a "map" of the details in the selection.

3. Now ask the students to turn their paper over and answer the questions.

4. Explain that this is a technique for recalling details and ideas. Mapping can also be used for a pre-writing activity.

5. Now put the words Mountain Lion in a circle on the board. Ask the students to give you information they know about mountain lions and questions they want to find out. Map this information in a similar manner.

6. Assign students or pairs of students to research part of the map.

7. Have the students write up the information and post it on a bulletin board for reference.

Discussion:

1. Use the maps to distinguish the similarities and differences between the two family structures and hunting techniques.

2. Have the students evaluate the benefits or detriments of each. Which family structure appears to be best for the young? In which do the young have a better chance for survival if the mother is injured or killed?

3. Have them compare habitats and evaluate the suitability for the hunting techniques.

Closure:

1. Have the students write a paragraph finishing the thought... "I would rather be a (mountain lion, African lion) cub because..."

2. Have them share their paragraphs with others, either whole class or small group.

Extension:

1. Make an assignment for each student to write about mountain lions. They may include any information gathered and posted, or add additional information they have researched.

2. Draw pictures to depict the two habitats and family structures.

Lion Hunt

The adult male lion has been called the "King of Beasts" for many centuries. Its round, shortened head with its powerful jaws and full mane do give it a regal appearance. Despite its strength and size, which is 20-50% larger than the female, this carnivore does not deserve its reputation as great hunter. In reality, the lion's size is related to its job as defender of the pride's territory.

Within the pride the smaller lionesses do most of the hunting. Males may survive totally on female kills. The lions' diet is made of animals which may weigh from 110-1,100 lbs. On occasion, they will eat small rodents, hares, birds, and reptiles.

On the open plains where they can be easily seen, lions hunt at night. If trees, bushes, and shrubs offer cover, they will hunt in the daytime.

As the hunt begins, the males will hang back. Their manes make them more conspicuous and easily seen. The females fan out and partially encircle the prey, cutting off escape routes. The lions use stealth to get within 100 feet (30 meters) of their prey. This is called stalking.

The lions will then charge. One of the lions will slap the prey on the flank or grab it before it can outrun them. Although some lions can reach speeds of 36 mph (58 km/h,) some of their prey can run 50 mph (80 km/h.) Once knocked down, the prey has little chance of escape. Large animals are suffocated either by a bite to the throat or by clamping the muzzle shut.

Lions do not pay attention to wind direction when hunting. They are more successful when hunting upwind of their prey. However, only one in four charges ends successfully.

The prey is eaten by all members of the pride, or group. The male lion's superior size gives it an advantage at the kill. Where many lions feed together, or the kill is small, squabbles break out. They are usually brief and serious injuries are rare.

Life is harder for the cubs. As many as 80% of the cubs may not live to be two years of age. Because they are poor competitors at a kill, cubs can starve during their first year. The survival of the cubs depends on an abundance of prey and the number of adults at a kill.

Read the question and think of your answer. Reread to prove your answer. Underline the proof.

1. What is a group of lions called? _____

2. Describe stalking. _____

_____

3. Describe the job of the lion and the lioness in the pride. _____

4. Why is the lion so much larger than the lioness? _____

_____

5. How could the pride increase its success during hunts? _____

_____

6. Why is it difficult being a lion cub? _____ 51 _____

Catch Me If You Can

Objectives:

The student will state that special adaptations allow animals to survive.

The student will demonstrate how an animal's ability to run is related to its survival.

Grade Level: 4-6
Materials: Student activity page, clock or stop watch, pencil.
Time required: 40 minutes.
Structure: Pairs, whole group discussion.
Resources: Project WILD.
Source: Adapted from TOPS Learning Systems, Animal Survival, *To Run or Not To Run.*
Skills: Math, science, health.

Background:

See student activity page.

Procedure:

1. Give each pair of students an activity sheet and instruct them to read the background information. Discuss briefly other information that students supply.

2. Repeat the question asked at the end of the student's information. If the cheetah is so well adapted to outrun other hoofed animals, why is it successful less than half of the time? Ask them to write a hypothesis.

3. Each pair is to decide who will be the cheetah and who will be the zebra. Have them read and follow directions. They can repeat the experiment and reverse roles.

Discussion:

1. Go over their results and their calculations. Have them compare with other pairs.

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2. Did it make a difference when roles were switched? What was the difference?

Closure:

The zebra runs slower, but has greater ability to manuever. If the cheetah has to switch directions to follow the zebra, it uses up valuable time. If the prey is not caught within the first few seconds, the cheetah has less chance of succeeding.

Extension:

Rabbits and hares also have the ability to out-manuever predators. In addition they use other adaptations such as camouflage and freezing. (See Project WILD for Quick Frozen Critters, Adaptation Artistry and The Thicket Game.)

Catch Me If You Can

The cheetah is the true speedster of the African grasslands, or savannah. It is the fastest of all land mammals. Its long flexible spine, powerful muscles, and unsheathed claws enable the cheetah to reach speeds of 60 miles per hour (96 km/h) in five steps. Imagine a sports car that can go from 0-60 mph in a few yards!

The cheetah uses the open country of the savannahs for its hunting territory. Bushes, trees, and tall grass make excellent cover for stalking. The cheetah may spend seconds or hours cautiously working its way close to its prey. When the prey is about 100 feet (30 m) away, the chase is on! The chase is usually only about 550 feet and lasts only 20 seconds. The cheetah then suffocates the prey by biting it in the throat. This is all done in one breath! As soon as the cheetah takes a second breath, the chase is over.

Question: The cheetah is a well-equipped and extremely capable predator. Yet, it is successful less than half of the time. Why?

Hypothesis: _____

_____

Materials: Clock with a second hand and a pencil.

Procedure:

1. Get a partner. Decide who will be the cheetah and who will be the zebra.
2. The cheetah must run in place as hard as possible. The zebra times how many seconds pass before the cheetah slows down.
   Time before cheetah slows: _____
   If the cheetah traveled 30 meters each second, how far did it go?
   30 x _____ seconds = _____ meters
3. Now the zebra must jog at an easy pace. The cheetah times how many seconds pass before the zebra slows down.
   Time before zebra slows: _____
   If the zebra travels 15 meters each second, how far did it go?
   15 x _____ seconds = _____ meters
4. Who can run further before slowing down?_____

Analyze:

1. If the chase lasted less than 20 seconds, who would be the winner?
   _____
2. If the chase lasted longer than 20 seconds, who would be the winner?
   _____
3. Who would have the advantage if the chase was in a straight line?
   _____
4. Who would have the advantage if the chase was in a zig-zag pattern?
   _____

Conclusion:

Why does the cheetah succeed in making a kill in only about half of its attempts?

_____

Never Invite A Burro To Lunch

Objectives:

The student will identify effects on native species habitat when a feral or domestic species is introduced.

Background:

Domestic animals that are introduced into the range of bighorn sheep have had an impact upon the quality of habitat. Burros that are allowed to return to a wild, or feral, state can survive by eating literally any vegetation that is available. They are both grazers and browsers. Domestic sheep bring with them certain diseases for which bighorn sheep have no immunities. They also lower the quality of the habitat if they are left on one area too long. The vegetation can be eaten down past the point where it can regrow to its former lushness in one season. Both sheep and burros also tend to foul water sources and drink more. Burros can actually destroy trees.

Grade Level: 4-6
Materials: Food tokens (different colors for each item)—30 each (grasses, catclaw,) 10 each (barrel cactus, hedgehog cactus), 30 each (wild flowers and forbes, salt cedar,) 25 white tokens, (disease and pollution.)
Time required: 40 minutes.
Structure: Whole group simulation.
Source: John Stair, Jean Contreras.
Skills: Math, science, social studies, critical thinking.

Procedure:

1. Select five students to be feral burros and five to be domestic sheep. The rest of the class are bighorn sheep. Give all students a small bag for a stomach.

2. Distribute food tokens on ground or floor. Hold onto white tokens. Have burros and sheep wait on sidelines. Send out bighorn sheep to collect tokens. They can collect only one at a time, returning to the sidelines to stow their food in their stomachs. Bighorn should separate, count and record the color and number of tokens they have.

3. Collect tokens and distribute on floor again. This time burros and domestic sheep are included. Give each one several white tokens. They must drop one token each time they go out to graze. They also may bring back only one food token at a time.

4. Proceed until all tokens have been taken. A few white tokens may be left on the ground.

5. Return to classroom and have students separate and graph different colors. Write key to colors on board.

Discussion:

1. Introduce the term competition. Why are burros, domestic sheep, and bighorn sheep in competition in this habitat? Help students to analyze the data they have gathered. Bighorn sheep should have two graphs.

2. Bighorn sheep that have gathered 10 or more tokens have survived if they have not picked up any disease (white tokens). Bighorn sheep have immunities to diseases brought into their range. The bot fly brought in by the domestic animals lays eggs in the bighorn sheep's nasal cavity. The larvae of this fly literally eats away the bony structure of the sheep's lower skull.

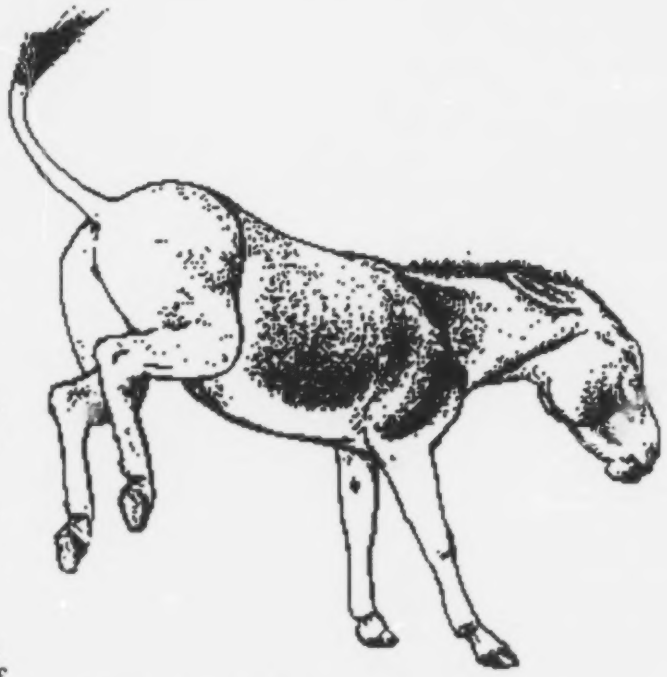
3. Compare the graphs of the bighorn sheep before and after the introduction of livestock. What happened to the amount of food available? Did the total amount change? Did the amount available for all to survive change? Which would be the more successful competitor for the food?

4. Have them discuss what impacts feral animals and domestic livestock like sheep can have on the habitat of native animals.

5. Have each student evaluate the variety of food collected. What would be the possible consequences if the food was only one type, i.e. hedgehog or barrel cactus?

Closure:

Native species like bighorn sheep have adapted to the kinds and amounts of food within their range. Non-native or feral animals like burros and domestic livestock compete with the native animals limiting the amount of food for both species. These animals also damage the habitat by overgrazing an area, polluting the water sources, and bringing in diseases for which the bighorn sheep have no defense.



Extension:

1. Have students play the parts of each of the humans responsible for these animals and defend their right to be there. (prospector who used burros to look for gold and turned them loose, a rancher who uses BLM land to graze his sheep, hunter, wildlife biologist, etc.

2. Encourage students to find out more about the Burro Adoption plan. Have them discuss whether this is a good or bad solution to the feral burro problem.

3. Other related problems are the wild horses in Nevada, California, and Utah . Feral pigs and goats in Hawaii, as well as introduced species like the mongoose, have all had impacts on native species.

4. Why are state game and fish biologists concerned about feral and domestic livestock? Have students contact local game and fish office.

5. Not all livestock has detrimental effects. Have students discuss habitat development for deer and elk as a result of ranch improvement.

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Mammal Mania

Objectives:

The student will describe the structure and function of adaptations of mammals.

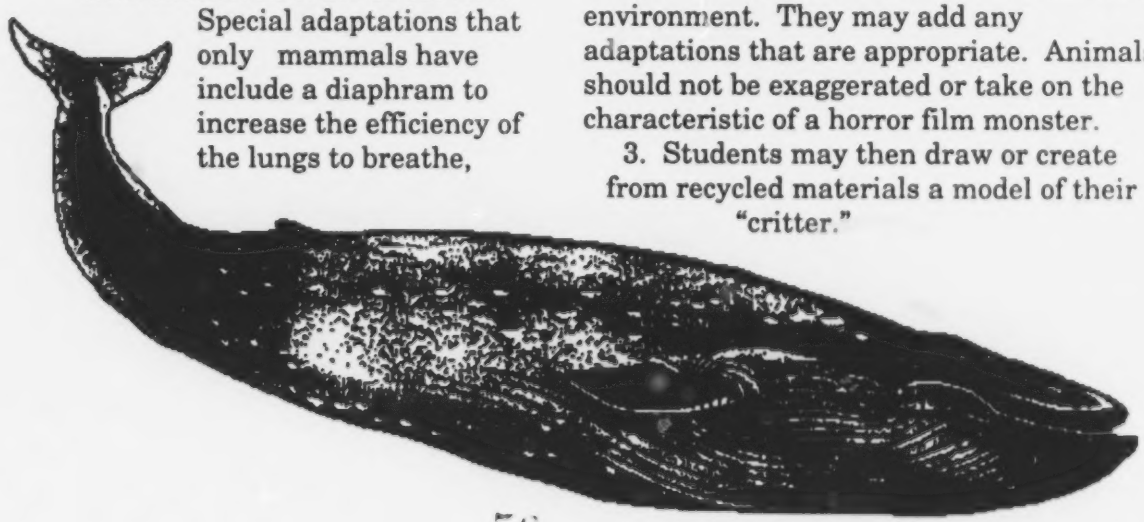
The student will construct an original creature with characteristics and adaptations of mammals.

Grade Level: 4-6
Materials: Drawing paper, or assorted recycled materials.
Time required: Two 40-minute periods.
Structure: Individual or group projects.
Skills: Art, language arts, science.

Background:

Mammals belong to a group of animals called vertebrates. They make up one group or class called Mammalia. Like most vertebrates, mammals have a bony backbone and a cranium, a hard case made of bone or cartilage that surrounds the brain. They are active and warm-blooded. Unlike other animals, female mammals nurse their young with milk that is produced in glands inside their bodies. However, some mammals, like the platypus, do not have nipples. Their milk oozes out of glands in their bellies, where the young suck it up. All mammals have mammary glands, but not all mammals have oil, sweat, or scent glands. Mammal skin not only protects a mammal, it also produces special structures such as hair, claws, nails, hooves, horns, and pads.

All animals must adapt to their environment in order to survive. Special adaptations that only mammals have include a diaphram to increase the efficiency of the lungs to breathe, specialized teeth, a complex central nervous system and enhanced senses, like smell, sight, and hearing. Size, shape, and body covering may be necessary to adapt to climatic variances. Coloration may be adaptive responses to other environmental factors. For example, the jaguar's spotted fur allows it to blend in with the patterns of light and dark in the jungle.



Procedure:

1. Introduce the words mammal and adaptation. On the board list those characteristics or examples supplied by the students during the discussion. A chart could be developed for later use.
2. Assign students into groups of 2-3. Each group is to decide on a particular kind of environment (forest, desert, marine, or grassland.) Tell them they are to create a new and original realistic mammal for a habitat within that environment. They may add any adaptations that are appropriate. Animals should not be exaggerated or take on the characteristic of a horror film monster.
3. Students may then draw or create from recycled materials a model of their "critter."

4. Give each group one sheet of writing paper. First student is to write a sentence describing one of their critter's adaptations and its function. The paper is then passed to the next student who writes about another of their critter's adaptations and its function. Continue until everyone has contributed.

Discussion:

1. Have each group display their critter and describe to the class the function of each adaptation.
2. Ask other students to suggest additional benefits from the adaptations.

Closure:

Show a picture of a real mammal and ask students to identify that animal's adaptations. Have them tell why those adaptations are necessary. For example, bats have wings, but no mammal has feathers.

Extension:

1. See also "Leaky Beaks."
2. Each group can write a fictional story about their critter and include it with a picture in a class anthology.

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It's Cold Out There!

Objectives:

Student will identify winter adaptations for individual arctic animals.

Student will organize information on arctic animals using outline format.

Background:

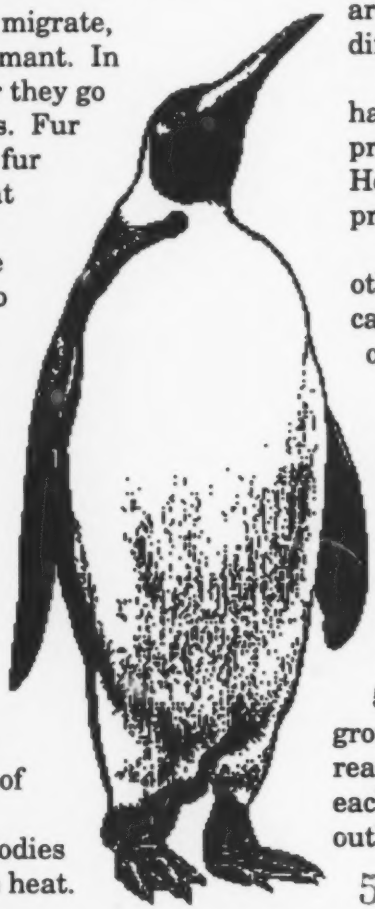
Animals have different needs during winter depending on their levels of activity and availability of food. In order for animals to live in cold climates they must adapt to the rigorous conditions of ice and snow.

Animals adapt in one of three ways:

1. They hibernate or become dormant.
2. They migrate to a more plentiful food supply.
3. They stay active and forage for the best available food.

Most animals neither migrate, hibernate, or become dormant. In order to cope with winter they go through physical changes. Fur or feathers change color, fur coats grow thicker and fat accumulates. Some animals' feet, such as the snowshoe hare, change to make walking on snow easier.

Other adaptations occurr through long-range physical changes. The caribou's feet became larger to accommodate not only snow but the marshy characteristics of the thawing tundra. Smaller ears of the arctic fox and snowshoe hare are other examples of long-range changes. Smaller, more compact bodies and extremities conserve heat.



Grade Level: 4-6
Materials: Student sheets 1 & 2; reference materials of arctic animals.
Time required: Two 30-40 minute periods.
Structure: Whole group instruction, individual or group follow-up.
Resources: Fisher, Roland M., *Animals in Winter.* Washington D.C: National Geographic Society, 1982, (K-6--Excellent photos.) Freedman, Russell, *When Winter Comes.* New York: E.P. Dutton, 1981.
Skills: Science, social studies, language arts, charts, art.

Procedure:

1. Show an example of an arctic animal in summer and winter. Ask students to identify animal. Are they two different animals or the same animal? If they are the same animal, why do they look different?
2. Have students describe the habitat that this animal needs. What problems does it have during winter? How does it adapt to solve these problems?
3. Ask students to give examples of other arctic animals. Examples: caribou, musk ox, arctic fox, snowy owl, ptarmigan, gray wolf, ermine.
4. List ways animals adapt to winter, i.e. hibernate, migrate, stay active, on board. Have students predict how they think each arctic animal adapts . Develop a chart if necessary. Headings could include: Species, winter habit, winter habitat (shelter), winter food sources, winter color.
5. Give each student or learning group copies of worksheets. Have them read the Thinking Strategies page. Give each group a time limit for completing outline.

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Discussion:

1. Ask students which animal was the easiest to complete. Which gave them the most difficulty? Why?
2. Have each group share additional strategies they used to complete the outline.
3. Ask groups to tell what new information they were able to learn about each animal through inferences or deductive reasoning.
4. What additional resources did the students feel would have been helpful?

Closure:

1. Have students summarize what they learned about arctic winter adaptations.
2. Have students list the three ways animals adapt to seasonal changes.

Extension:

1. Assign groups to create winter murals that illustrate a arctic habitat and the animals that share it.
2. Encourage students to research other arctic animals as follow-up and report back to class.

ANSWER KEY:

I. Caribou
   A. Migrates south in large herds to winter feeding grounds.
   B. Coat becomes lighter in color
   C. Sheds antlers in December
      1. Feeds on lichens
      2. Scrapes away snow with large plate-size hoofs

II. Ermine
   A. Coat changes from dark
   B. Winter pelt used for expensive coats
   C. Preys on rodents and rabbits

III. Ptarmigan
   A. Plumage
      1. feathers turn
      2. dark colored
   B. Lives in rock crevices
   C. Feeds on leaves and seeds

IV. Snowy Owl
   A. Barred plumage
   B. Unlike most owls, it is a diurnal hunter
   C. Builds snow caves during storms
   D. Uses talons to catch lemmings, rodents, and birds

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It's Cold Out There!

In order for arctic animals to survive, they must adapt to extremely cold conditions. They adapt themselves in one of three ways:

1. Hibernate or become dormant.
2. Migrate to a more plentiful food supply or warmer climate.
3. Stay active and forage for the best available food.

Directions: Use the information on the next page to fill in the outline.

I. _____

A. _____

B. Coat becomes lighter in color

C. _____

1. _____

2. _____

II. _____

A. Coat changes from dark to pure white with black-tipped tail

B. _____

C. _____

III. _____

A. _____

1. feathers turn pure white in winter

2. dark-colored tail feathers

B. Lives in rocky crevices

C. _____

IV. _____

A. Barred plumage turns mostly white

B. _____

C. _____

D. _____

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It's Cold Out There!

Thinking Strategies:

1. Find all the animal names and fill in the Roman numerals. Write them in alphabetical order.
2. All clues that begin with capital letters are subtopics . Find those that seem to match one arctic animal. Write these clues on the lines with capital letters.
3. All remaining clues are details and begin with small letters. Match these to the numbered lines.

Clues:

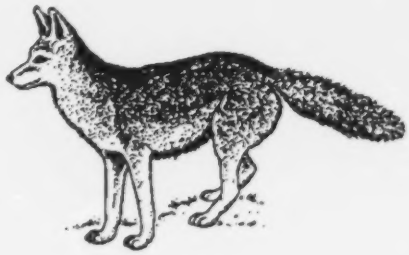
Ermine
Winter pelt used for expensive coats
Feeds on leaves and seeds
Plumage
Caribou
Unlike its cousin, it is a diurnal hunter
feeds on lichens
Snowy Owl
Builds snow caves during storms
Ptarmigan
Preys on rodents and rabbits
scrapes away snow with large plate-size hoofs
Sheds antlers in December
Migrates south in large herds to winter feeding ground
Uses its talons to catch birds, lemmings, and other rodents

Research one of the following arctic animals and develop your own outline. Be sure to include information on winter adaptation, food and shelter.

Musk Ox

Snowshoe Hare

Arctic Fox



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Three Bears Tale

Objectives:

The student will compare and contrast the size and shape of three bears– polar, brown (grizzly,) and black.

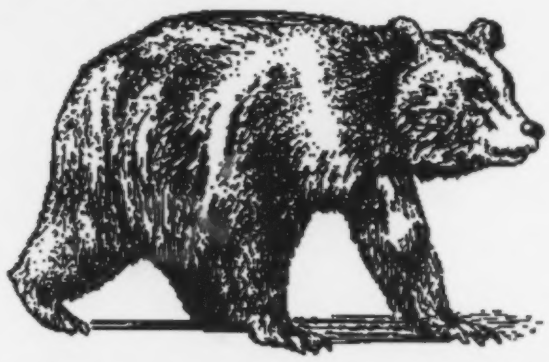
The student will create a life-size drawing from a scale drawing.

Background:

Polar bears have long necks, slender heads, and white fur. They live along the arctic coast, mostly on the polar ice. They feed mainly on fish and seals. Their thick fur keeps them warm, and the webbing between their toes makes them good swimmers.

Brown bears dig up most of their food, so they have long claws. They have a distinctive hump between their shoulders. They have a wide head and a "dished" face. They eat roots, tubers, ground squirrels and other small rodents, marmots, and carrion. They occasionally kill a larger animal for food. Brown bears (grizzlies) tend to live on the edges of forests, but feed mostly in mountain meadows.

Black bears are quiet, shy animals that live in a variety of habitats from forest to brush or chaparral. The black bear may be black, auburn, or cinnamon. They are smaller than brown bears or polar bears and their heads are more pointed. They eat mostly nuts, berries, and fruit. They also eat rodents, insects, and occasionally kill larger animals for food.



Grade Level: 4-6
Materials: Butcher paper, bear patterns, overhead or opaque projector, pencil.
Time required: 20 minutes for each bear.
Structure: 2-3 students per bear, or teacher makes for teaching aide.
Resources: Project WILD - *How Many Bears Can Live In This Forest? What Bear Goes Where?*
Source: Al LeCount, Arizona Game & Fish.
Skills: Art, math, science, social studies.

Procedure:

1. Copy each of the bears from the bear pattern page onto a separate sheet of paper (for opaque projector) or make transparencies (for overhead.)
2. Hang butcher paper on wall. Polar bear gets very large. Can use white for polar, brown for brown, and black for black.
3. Project silhouette onto wall and enlarge until it reaches the shoulder height indicated on bear pattern.
4. Trace outline of bear, take it down and cut it out.
5. Find a place to hang the outlines side-by-side. Have them label their bear.

Discussion:

1. Have them discuss a comparison of the sizes in relation to each other and themselves.
2. Have them compare and contrast the shapes, i.e., neck size and shape, leg length and width, head shape.

Closure:

Have the students summarize what they learned from the activity about the similarities and differences in the bear family.

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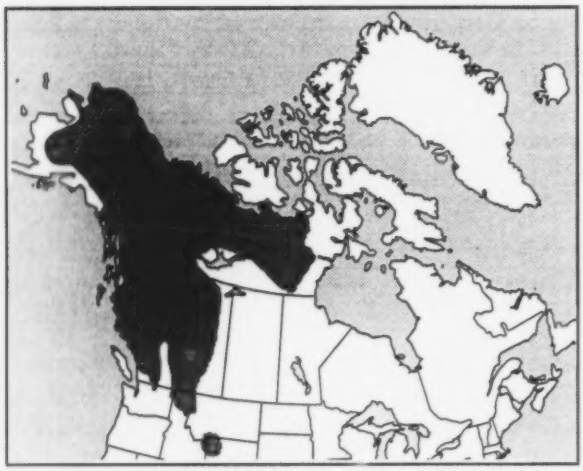
Extension:

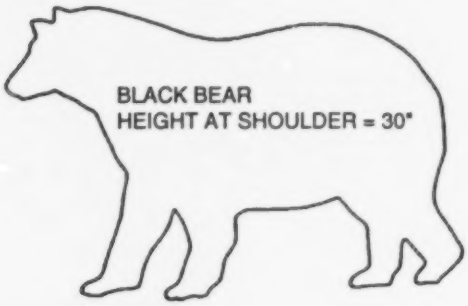
1. Have students prepare a chart starting with shoulder height and measure length from nose to rump, height and width of legs, nose length to eye break.

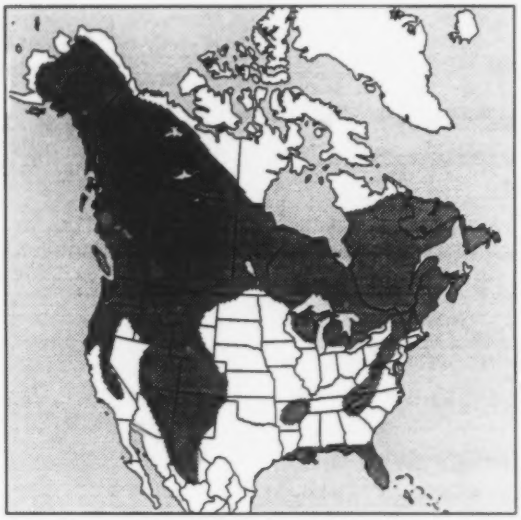
2. Have them research to find the following to add to their charts: weight, life span, etc. Information can indicate their own interests.

3. Build a bear den to fit the bear. See "Home Sweet Home."



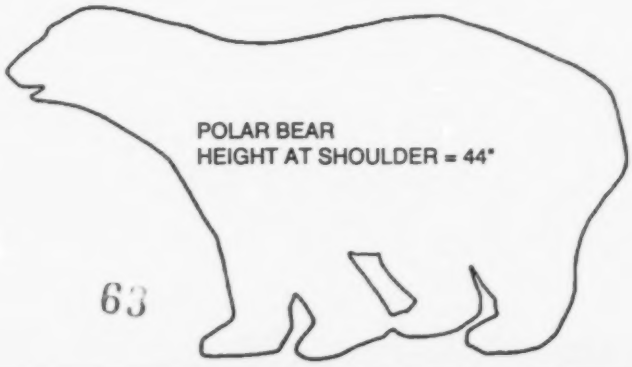
Distribution of Grizzly Bear





Distribution of Black Bear

Distribution of Polar Bear



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Hoof and Horns

Grade Level: 4-6
Materials: Reference books on wildlife student information sheet.
Time required: 40-60 minutes.
Structure: Whole group, individual or paired research.
Resources: Sheep or goat student sheet, reference books.
Source: Jean Fields, Jean Contreras.
Skills: Language arts, science, research.

Objectives:

The student will identify members of the ungulates by the number of toes and kind of horns. **Ungulates** are hoofed mammals and their relatives.

Background:

Many mammals are ungulates. Their teeth are adapted for chewing. Primitive ungulates include elephants and hyraxes. The rest are divided by the number of toes they have. Odd-toed ungulates include tapirs, horses, asses and zebras. Even-toed ungulates include deer, cattle, sheep, goats and antelopes. Many even-toed ungulates ruminate by rechewing the food (cud) they have stored in their stomachs. Only the deer family has antlers. The rest of the even-toed group have horns that either curl, arc, or spiral.

Procedure:

1. Introduce the word ungulate. Give the background information as stated above. Be sure to include the information on number of toes.
2. Explain that ungulates are distributed worldwide. Many of these are sheep, goats, or antelopes.
3. Refer to student page for description of different types of horns.
4. Assign them a list of assorted sheep, goats and antelopes to research.
5. Have them organize the information into the following:
    a. classification name (sheep, goat, antelope)
    b. found on what continent
    c. number of toes
    d. type of horn
6. Have them divide into research teams. Review how to use an index to find their animals.
7. Encourage them to develop a neat, clear poster format for displaying their information.
8. Have students list at least two references used to gather information. Review the correct way to write references for a bibliography.

Discussion:

Discussion may come from their research or the process of doing research. An informal introduction to taxonomy may be necessary to give the students an understanding of the science of classifying or grouping organisms by characteristics. See "Mammal Mania" for a related activity.

Closure:

Have the pairs report on their research, stating the information that surprised them. Information should be clearly stated and their research posted for all to read later.

Extension:

1. Set up teams to include other ungulates, such as elephants, cattle, and horses.
2. Have students gather pictures of ungulates and learn to identify them by their characteristics.

Hoof and Horns

Below are listed a few of the sheep, goats, and antelopes that are usually found in a natural history museum. These are given as suggestions. Feel free to add any others you wish.

GOATS AND SHEEP:

chamois
mountain goat
musk ox
Himalayan tahr
Barbary sheep
blue sheep
ibex
markhor
tur
urial
argali
mouflon
thinhorn sheep
American bighorn sheep

DWARF ANTELOPE AND GAZELLE:

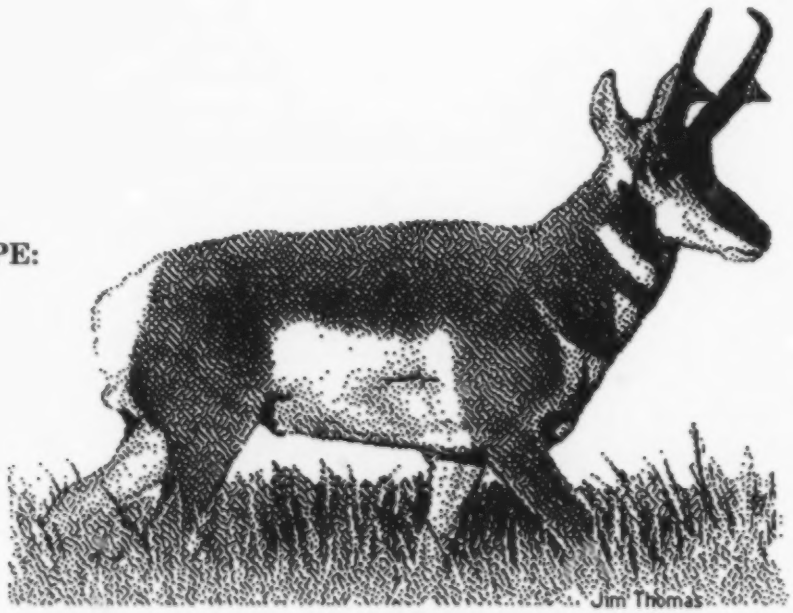
royal antelope
dikdik
duiker
klipspringer
oribi
gazelle
blackbuck
springbuck
gerenuk
dibatang

GRAZING ANTELOPE:

rhebok
kob
topi
wildebeest
impala
gemsbok
addax

SPIRAL-HORNED ANTELOPE:

kudu
bongo
eland



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Tracking Bighorn Sheep

Objectives:

The student will demonstrate an understanding of limiting factors and their influence upon populations.

Background:

Animal populations thrive in environments which supply their needs. Within the environment a variety of habitats exist: grasslands, cliffs, riverbanks, etc. Each of these has the potential to supply the food, water, and cover or shelter for a particular animal. That animal will range between those habitats which supply their needs. If the habitats improve, other animals may move in. This can cause increased competition between species. Limiting factors for the survival of these animals are the total amount of food, water, shelter, and space. Other limiting factors can be man-made, such as roads.

Procedure:

1. Give each student a fact sheet on Bighorn Sheep. Discuss the specific habitat requirements needed for the sheep. Have the students key into how the bighorn have adapted to the limiting factors in its area. i.e., wide dietary habits in an area of sparse vegetation, ability to go 4-10 days without water, etc.

Grade Level: 4-6
Materials: Student activity sheet, map of bighorn sheep range.
Time required: 40-50 minutes (2 periods.)
Structure: Whole group, students in pairs.
Resources: Fact sheet on bighorn sheep.
Skills: Science, social studies, critical thinking.

2. Give all students a map and have them track the sheep, identifying the limiting factors. Discuss the difference between a natural limiting factor, such as low rainfall, and a man-made factor, such as the highway through their range.

3. Have the students analyze their maps and propose a site for a manmade waterhole. Have them give their reasons for placing it at a particular coordinate.

Discussion:

1. Discuss the word competition. Could the additional wildlife cause problems for the bighorn? Have them describe possible situations which could arise.

2. Review the term predation. What predators would take advantage of the new situation? What influence would this have on the bighorn population.

Closure:

Ask students to give a definition for limiting factors. Have them summarize some of the limiting factors they identified and the influences they can have on the population of a species within a particular range.

Extensions:

A new waterhole can bring in other wildlife such as birds, reptiles, and coyotes. Ask students to predict what kind of wildlife might be attracted by the new water source.

66

Tracking Bighorn Sheep

Directions: Below is a portion of a biologist's log book. Find each place described on the map (page 58) and label the event with a word or a picture. Tracks can be shown with a line of xxx's and arrows showing the direction the animal was going.

DATE:	EVENT:
4/ 6	Ewe seen crossing the highway headed south. F-15
4/ 7	Coyote den found with 3 pups. G-7
4/ 8	Ewe seen drinking at river. E-5
4/ 9	Mountain lion den discovered. H-12
4/10	Collared ewe 307 seen grazing around sewage ponds. E-13
4/11	Collared ewe 307 seen crossing road headed north. E-15
4/12	Collared ewe 307 found with newborn lamb. D-16
4/13	Large ram seen with 5 younger rams heading north. G-5
4/14	Coyote seen at I-5 headed north.
4/15	Group of 6 rams cross road headed north. H-14
4/16	Evidence of lion kill of lamb at H-10.
4/17	Tourists at beach report 5 ewes and 3 lambs coming down cliff on west side of river. D-5
4/18	Highway patrol reports that ewe was found on highway after being struck by a truck. E-15
4/19	Grasslands discovered at K-2.

Directions: As the wildlife biologist, you must identify the limiting factors for the sheep.

1. _____
2. _____
3. _____

Directions: Pick one natural and one man-made limiting factors you identified. Propose a solution that would help increase the chances of survival for the sheep. Defend your solution.

1. Natural: _____

_____

_____

2. Man-made: _____

_____

_____

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Managing Bighorn Habitat

Use the map from **"Tracking Bighorn"**

Directions: Pretend you are a wildlife officer. Your boss wants you to propose a site for a new waterhole for the Bighorn sheep in your area.

1. Where would you put it? _____ (Give coordinates.)

2. Give your reasons for placing it there. _____

   _____

   _____

3. Could the water also bring in other wildlife? _____

   What wildlife could it attract? _____

4. Can you think of any problems the new water source might cause? Would there be competition? If so, describe the possible situations that could arise.

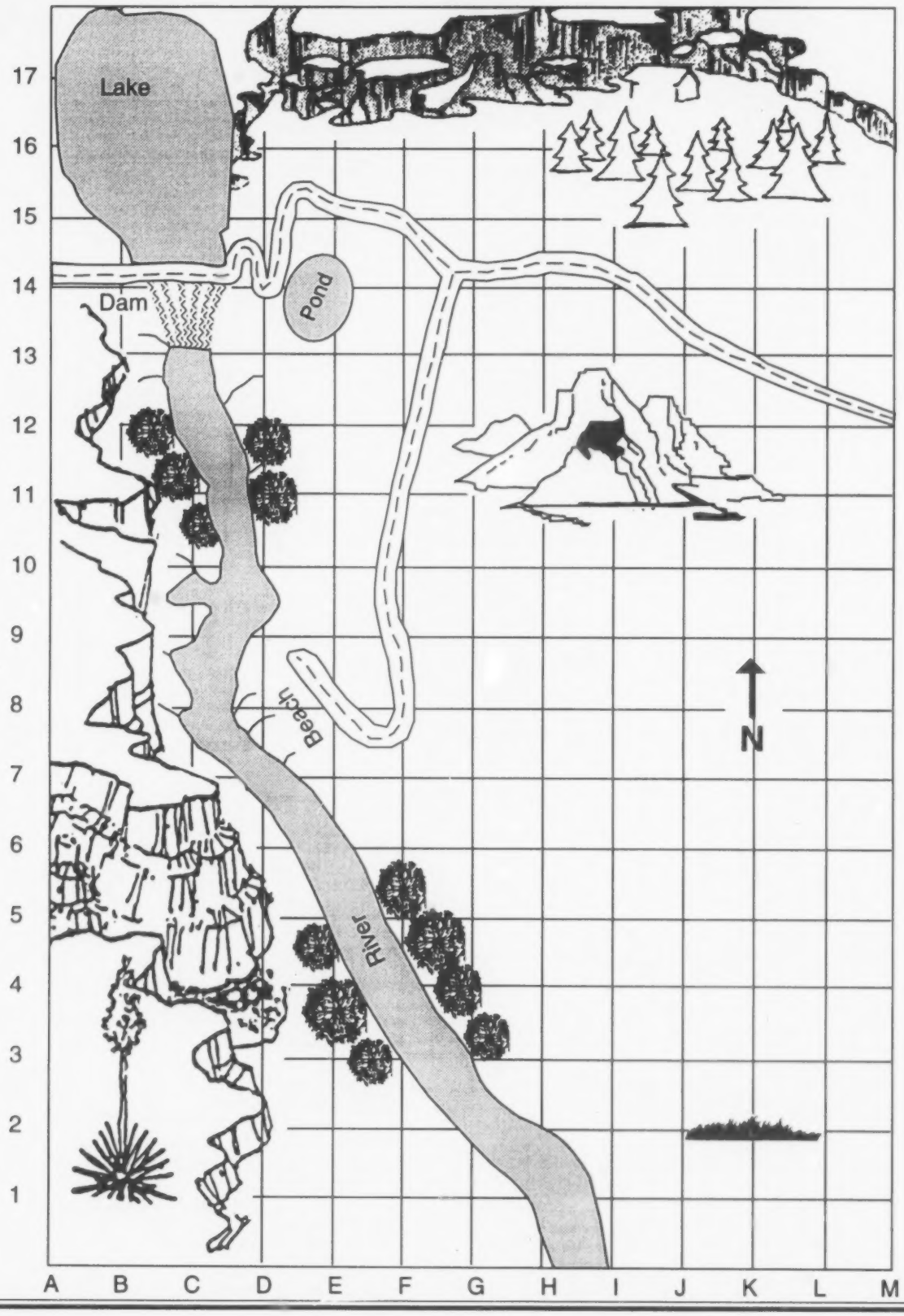
   _____

   _____

   _____

5. Draw a picture of your new waterhole and the wildlife that will use it.

Tracking Bighorn Sheep



Let's Go On Safari

Objectives:

The student will identify animals as specific to certain continents.

The student will recognize the diversity of animals within a family.

Background:

All of the continental masses were once part of a supercontinent called Pangea. When this mass broke up, the animal species were isolated and developed independently. Some species like the camels and horses on North America died out. Other species migrated as land bridges formed during the Ice Ages. Antarctica slipped so far south that only marine mammals were able to survive the extreme climates. Animal species survive best where the habitat meets their needs. Competition may necessitate that subspecies evolve which can utilize special areas of the same habitat. This is especially illustrated by the incredible diversity among Bovidae family in Africa which all live on the savannahs, or grasslands.

Procedure:

1. To begin, first student draws a location card which gives a longitude and latitude. The student must find that location on the map and name the continent.

Grade Level: 4-6
Materials: Two sets of cards: family cards, location cards, map of world with longitude and latitude.
Time required: Variable.
Structure: 4-6 players.
Skills: Science, social studies.
Source: Jean Contreras.

If the continent is incorrectly named, the player loses his/her turn.

2. If the continent is correctly named, the student to the right draws a family card. The player is told the animal family on the card and is asked to name a member of that family that lives on that continent. The player may say there is no family member on that continent. If the player gives an incorrect response, he/she will be told the correct answer for next time.

3. The correct response for naming the continent gives the player 1 point. Each correct response for a correct family member gives the player 5 more points.

4. Play then passes to next player to the right. Continue as above until one player gets 100 points. Used cards are put on bottom of deck.

Closure:

Completion of game.

Extension:

1. Have students follow interest to make reports on animals that interest them.

2. Encourage students to write stories to explain why a camel looks different from a llama or an alpaca, etc.

3. Use Kipling's *Just So* stories to illustrate one author's idea of why the animals look so different.

Family: Even toed Camelidae (Camel, Llama)
N. America: None. Pick new location.
S. America: *Llama, Alpaca, Vicuna, Guanaco*
Europe: None. Pick new location.
Africa: *Dromedary camel*
Asia: *Dromedary camel, Bactrian camel*
Australia: *Dromedary camel* (feral)

Family: Even-toed Giraffidae (Giraffe)
N. America: None. Pick another location.
S. America: None. Pick another location.
Europe: None. Pick another location.
Africa: *Giraffe, Okapi*
Asia: None. Pick another location.
Australia: None. Pick another location.

Family: Even-toed Bovidae (Grazing Antelopes)
Any except Africa: Lose turn.
Africa: 3 tribes 1. High bouncing jumps, whistles, male is horned: *Reedbuck, Rhebok, Kob, Waterbuck, Lechwe, Puku 2.* Large pop.: *Topi, Bontebok, Hartebeest (gnu), Impala 3.* Horse-like: *Roan antelope, Sable antelope, Addax, Oryx*

Family: Even-toed Bovidae (Gazelles)
N. America: None. Pick another location.
S. America: None. Pick another location.
Europe: None. Pick another location.
Africa: *gazelle, springbuck, gerenuk, dibatag*
Asia: *gazelle, blackbuck*
Australia: None. Pick another location.

Family: Even-toed Tragulidae (Chevrotains, Mouse Deer)
N. America: None. Lose a turn.
S. America: None. Lose a turn.
Europe: None. Lose a turn.
Africa: *Water chevrotain*
Asia: *Mouse deer*
Australia: None. Lose a turn.

Family: Even-toed Cervidae (Deer)
N. America: *Wapiti (elk), Mule, White tail, Moose, Caribou (reindeer), Red brocket*
S. America: *White tail, Roe, Huemel, Pudu, Red brocket*
Europe: *Fallow, Red, Moose (elk), Caribou*
Africa: *red* **Asia:** All of above, *Chital, Hog deer, Thorold Sika, Rusa, Sambar, Pere David*
Australia: no native deer, introduced

Family: Even-toed Bovidae
N. America: *American bison*
S. America: Water buffalo (domestic)
Europe: *Water buffalo (D), Eu. bison*
Africa: *Water buffalo, Sitatunga, Nyala, Kudu, Bushbuck, Bongo, Eland*
Australia: None. Pick another location.

Family: Even-toed Bovidae (Dwarf Antelope)
N. America: None. Pick another location.
S. America: None. Pick another location.
Europe: None. Pick another location.
Africa: *Royal, Suni, Dik-dik, Klipspringer, Oribi*
Asia: None. Pick another location.
Australia: None. Pick another location.

Family: Even-toed Bovidae (Goat-Antelope)
N. America: *Mountain goat, Musk ox, Am Bighorn Sheep, Thinhorn sheep*
S. America: None. Pick another location.
Europe: *Chamois, Ibex, Wild goat, Mouflon,*
Africa: *Ibex, Barbary sheep*
Asia: *Chamois, Tur, Markhor, Blue Sheep, Tahr, Wild goat, Urial, Mouflon, Argalis*
Australia: *Chamois (introduced)*

Family: Felidae (Cat)
N. America: *cougar (mt. lion, puma), bobcat, lynx, jaguar*, ocelot, margay
S. America: *jaguar*, ocelot, margay
Europe: wildcat
Africa: *lion, leopard*, cheetah, caracal
Asia: *tiger, leopard*, cheetah, caracal
Australia: none. Take an extra turn.

Family: Canidae (dog)
N. America: *gray wolf, coyote, gray fox, arctic fox*, kit fox
S. America: *gray wolf*, maned wolf, bush dog
Europe: *gray wolf, gray fox, arctic fox*
Africa: *jackal*, bat-eared fox, African wild dog, fennec fox
Asia: *wolf, jackal, arctic fox*, Ind. fox, dhole
Australia: dingo

Family: Ursidae (Bear)
N. America: *polar, American black, brown (grizzly)*
S. America: spectacled
Europe: *brown (grizzly)*
Africa: none. Take an extra turn.
Asia: *polar*, sun, sloth, Asia black, *brown*
Australia: none. Bonus card.

Family: Procyonidae (Raccoon)
N. America: *raccoon*, coati, ringtail, cacomistle
S. America: *raccoon*, coati, kinkajou, olingo
Europe: none. Lose a turn.
Africa: none. Take an extra turn.
Asia: giant panda, red panda
Australia: none. Go to another location.

Family: Mustelidae (Weasel)
N. America: weasel, *badger*, ferret, otter, marten, ermine, mink, skunk, fisher, wolverine
S. America: grison, weason, tayra, skunk, otter
Europe: weasel, polecat, ermine, mink, badger, marten, otter, wolverine
Africa: zorilla, otter, badger
Asia: weasel, ermine, polecat, badger, otter, wolverine
Australia: none. Lose turn.

Family: Mongoose
N. America: none. Lose turn.
S. America: none. Go to another location.
Europe: none. Take another card.
Africa: *slender mongoose, large spotted genet, civit*
Asia: mongoose, genet, civet
Australia: none. Lose turn.

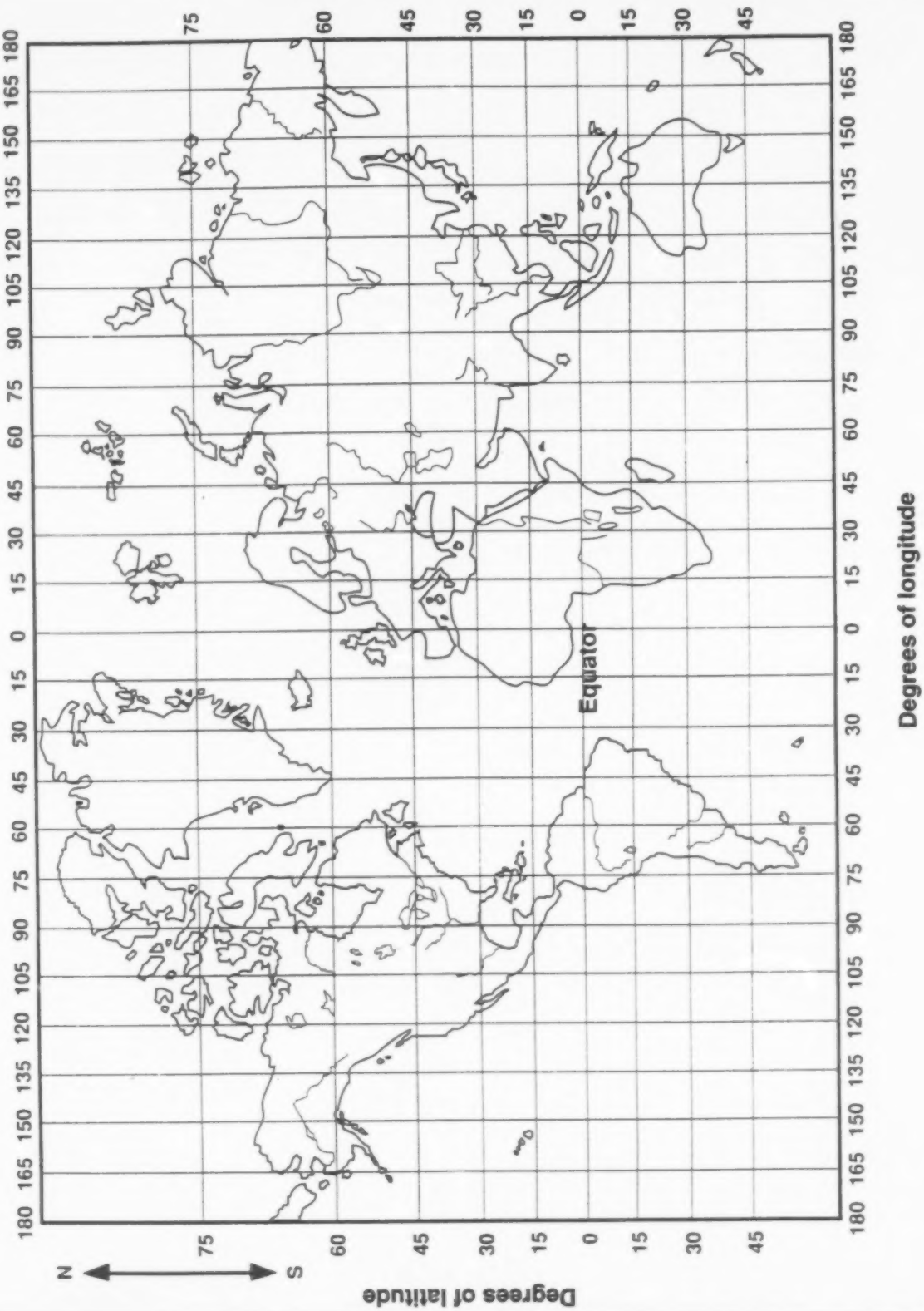
Family: Hyaenidae (Hyena)
N. America: none. Take another card.
S. America: none. Go to another location.
Europe: none. Lose a turn.
Africa: *spotted hyena*, striped hyena, aard wolf
Asia: striped hyena
Australia: none. Lose a turn.

Family: Primitive ungulates (Elephants, etc.)
N. America: none. Lose a turn.
S. America: none. Go to another location.
Europe: none. Take another card.
Africa: *African elephant*, hyrax, aardvark
Asia: Asian elephant
Australia: none. Go to another location.

Family: Perissodactyla (Odd-toed)
N. America: tapir, domestic horse
S. America: tapir
Europe: none. Go to another location.
Africa: African ass, *zebra*, blk/*wht rhino*
Asia: Przewalski's horse, Asian ass, *Indian rhino, Javan rhino, Sumatran rhino*
Australia: none. Lose turn.

Family: Artiodactyla (Even-toed)
N. America: *collared peccary (javelina)*
S. America: none. Go to another location.
Europe: *wild boar*
Africa: *warthog, bush pig, wild boar, giant giant forest hog, hippo, pygmy hippo*
Asia: *wild boar*
Australia: none. Lose turn.

Let's Go On Safari



Is It Real?

Objectives:

The student will make a model demonstrating how animal exhibits are prepared for display in a natural history museum.

Background:

Visitors to natural history museums see unusual and exotic examples of wildlife from around the world. The lifelike exhibits are created by museum artists from natural animal materials. Accurate measurements are made of the animal from a treated skin. The artist then uses a pre-formed body of plastic or fiberglass. Older models were made of wire, shredded wood, clay, plaster, or paper mache. The skin is stretched, sewn, and glued in place over the form. Many body features are added, such as eyes, tongue, teeth, and/or claws. The natural materials may come from more than one animal. The eyes are made of glass or painted hollow globes, which give the animal a natural expression. When finished, the animal is placed in a life-size diorama depicting its natural habitat.

Procedure:

1. Explain the term "natural history museum." Zoos do not always have examples of all the wild animals in the world. They may not have be able to acquire live specimens or have room to exhibit them. A natural history museum can exhibit animals together in life-like situations not possible in a zoo.

2. Give students background on how animals are prepared for exhibition in a natural history museum. (A good resource is the book, *Are Those Animals Real?*)

Grade Level: 4-8
Materials: Gather as many as possible (other materials may be used): clay, chicken wire, fake fur, cloth remnants, burlap, feathers, wire clothes hangers, assorted lengths of sticks, paper-mache, cotton, foam , straws, paint, fake eyes (from hobby stores) or marbles.
Time required: 2-5 class periods.
Structure: Individual or group projects.
Resources: Cutchins and Johnson, *Are These Animals Real: How Museums Prepare Wildlife Exhibits*. Wm Morrow and Co., N.Y. 1984.
Skills: Art, science.

3. Tell students that they will be making a replicated model of an animal similar to the way the museum artist prepares an exhibit. Their model can depict a real or imagined animal.

4. Determine the size of the animal. Construct a form. Form can be built of wire, straws, or sticks. It can be carved from foam or molded out of clay.

5. Cover form with paper-mache and mold body shape. Remind students to pay attention to proportions, head-to-legs, etc. Cover model with a material to represent outer body covering, like fake material, pine cone scales, etc. Insert eyes, or other features. Paint, if desired.

Closure:

Have students display their models and explain the construction.

Extension:

1. Have students give their model a name and write a story about it.

2. Have students design a diorama to exhibit their model. See also "Tour the World" and "Mammal Mania."

Tour The World

Objectives:

1. Student will list and describe different life zones.
2. Student will demonstrate the diversity of living things within a life zone by creating a display.
3. Student will communicate through visual, oral, and written modes information researched regarding flora and fauna of life zone.

Grade Level: 4-8
Materials: reference books, map(s) of continent(s) showing life zones., cardboard, clay, paper mache' , other art supplies Tour the World project guide.
Time required: 2-4 weeks.
Structure: individual or group research and presentations.
Resources: ***Merriam's Life Zones.***
Source: Jean Fields.
Skills: Language arts, science, social studies, reference.

Background:

Dioramas and replicated models are used in natural history museums to communicate information about life zones and the animals which inhabit them. Most of these areas are never seen by the general public. Extensive research is necessary to place animals in their correct habitats and give the viewer a sense of realism and drama.

Life zones are related to latitude as well as altitude. Climate conditions are influenced by the land forms in the area. One side of a mountain range can be a rain forest while the other side, in the "rain shadow", will be desert. (See "Rainfall in the Forest", Project Learning Tree).

The four basic life zones which are common to most of the continents are: rain or mixed conifer forest, desert or tundra, grassland (savannah), and marine. Each life zone has flora and fauna that are indigenous to it.

Procedure:

1. Give each student a map of a continent showing life zones. Have them read key and locate the different life zones. Develop concept of a life zone and characteristics of each zone. Have class brainstorm the animals that might inhabit each life zone.
2. Assign a life zone to each group to research. Groups are to proceed following format of project guide. Set timetable for completion of first part (Getting Started). Results could be compiled into one research notebook.
3. Give students examples of types of displays. Possiblities include dioramas (life and scale size), murals, kiosk, etc. Be sure to give suggestions on sources of materials (recycle!). Have students submit a diagram of how they plan to construct their display. Set time limit.
4. Each group will research 3 animals each that live in their life zone. Reports should be included in a notebook.
5. Students will construct display and prepare presentations on the animals they researched.

Discussion:

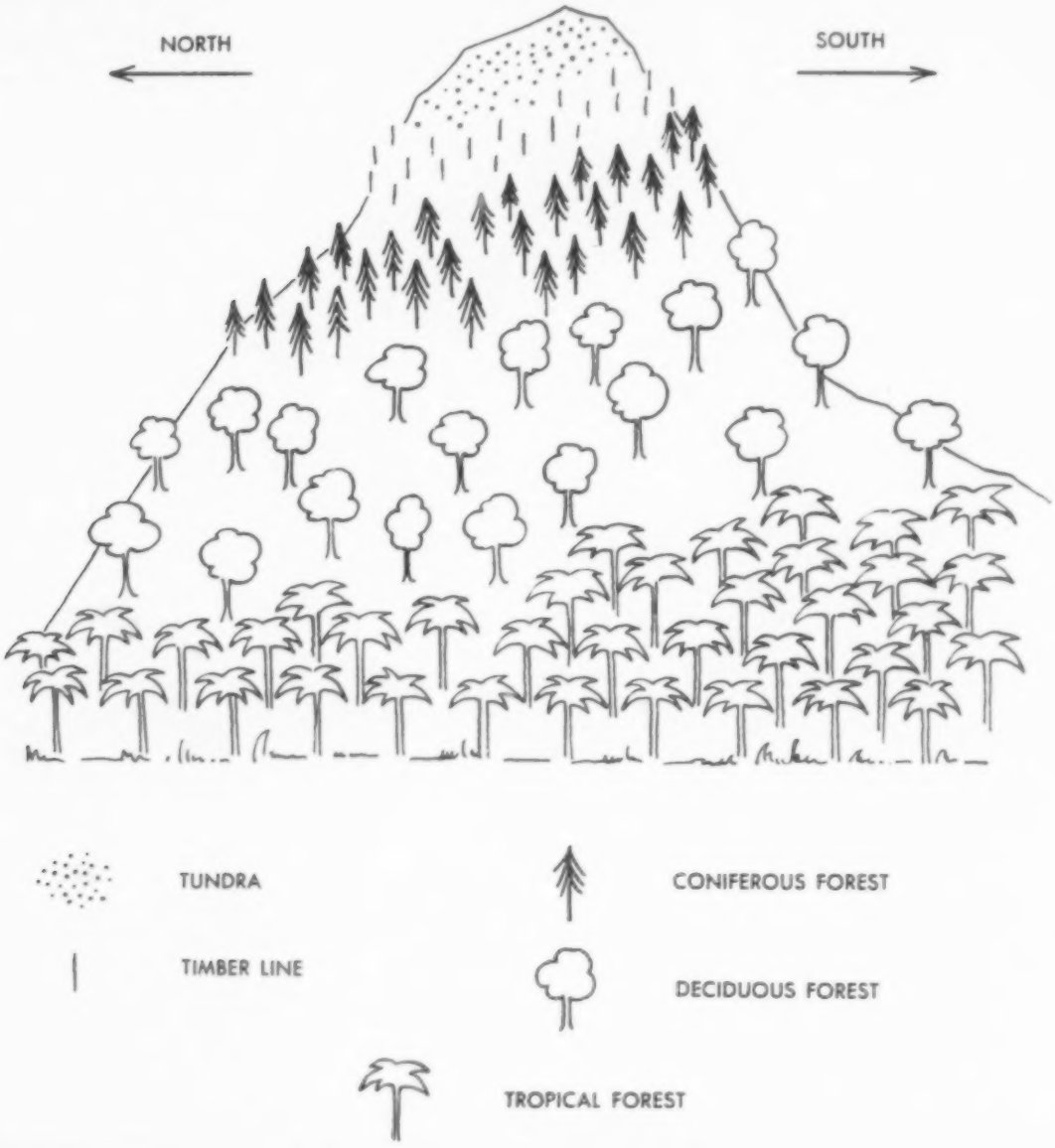
1. What part does geography play in the diversity of plant and animal life?
2. How could movement of the continents affect the type of vegetation? The animal life?

Closure:

Students will plan a tour of the other life zones. At each station, the presenters will explain the characteristics of their life zone and the flora and fauna which live there.

Extensions:

1. In the study of a particular country, identify the resources which each life zone might have.
2. Invite other classes to **"Tour the World."** For classroom management, issue passports with visas to specific areas.



Tour The World

Project Guide

Life Zone: _____

I. Getting Started: Assign topics to each group member. Write their names.

A. Land forms and map of world distribution: _____

B. Altitude, climate, & weather patterns: _____

C. Vegetation: _____

D. Animals: _____

Notebook due: _____

II. Design Display: Due: _____

Describe or sketch how it will look.

III. Animal Research: Due: _____

Keep notes on notecards. Each person picks 3 different animals, not all the same. For example: one mammal, one bird, one reptile.
Include the following information for each animal:

name
family
description
habitat
niche
special adaptations
interesting facts

Write short paragraphs for each animal for your notebook and include a drawing or picture.

IV. Complete your display and prepare your presentation.

Due: _____

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Why Do We Have National Parks?

Did you know that Yellowstone was the first national park in the world? Congress set it aside way back in 1872 to preserve the area for us to enjoy. Today there are 50 national parks out of the 358 areas in the United States managed by the National Park Service. Many other countries in the world have followed our example and set aside natural and historic and recreational areas for their people to enjoy.

With our expanding population and the need for more living space, places with fresh air and clean water are getting more scarce. It is important that we save enough of our land so that someday your children can enjoy the things we enjoy today.

We call this "Environmental Awareness." That means being aware of what each one of us can do to make our world a better place in which to live. Parks are nice, but you can't always live close to one. In the meantime why not look around your own neighborhood and homes for things that you can do. Maybe you can plant a tree or some flowers or maybe you and your friends can clean up the vacant lot next door. There can be a lot of beauty in a small place if it is clean and has something growing on it.

National parks are places set apart to be kept just as they are because they are important to our country. They usually are famous for some natural features like the deep, river-cut Grand Canyon or the beautiful stone trees of the Petrified Forest, or the spectacular Indian ruins of the Southwest. National parks are managed by the National Park Service of the Department of the Interior.

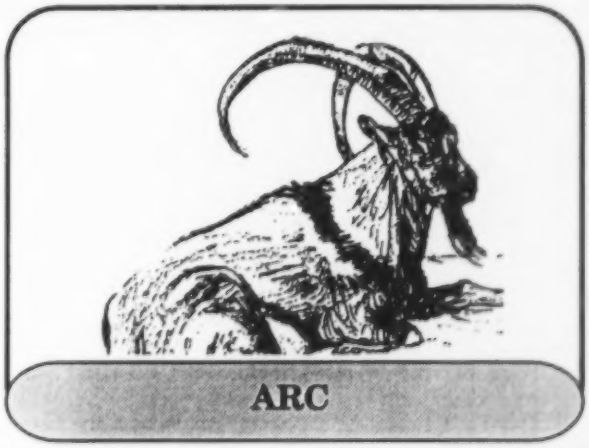
In the International Wildlife Museum there is an area where you can learn about the National Parks in other countries as well as the United States.

Things you can do:

1. Write to a national park for information.
2. Visit a national park near you.
3. Research about a national park and write a report.
4. Plant flowers or trees in your area to make it more beautiful.
5. Invite a park ranger to come to your classroom.
6. Discuss with your classmates some of the national parks they have visited.

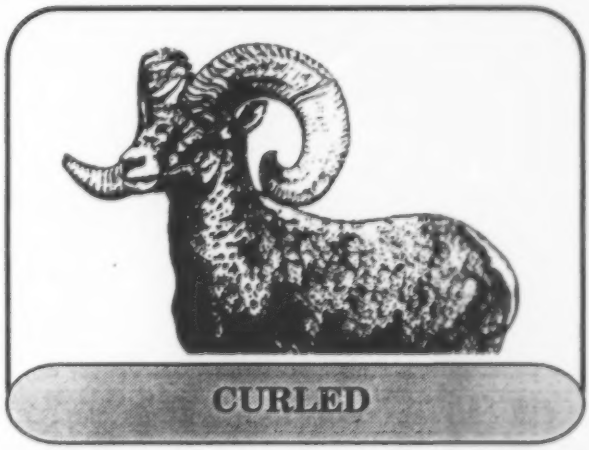
Sheep or Goats

Sheep and goats are closely related and are classified in the same subfamily (Caprinae) of the family Bovidae. Most sheep are in the genus Ovis and most goats in the genus Capra. In the past, sheep and goats were classified largely on the basis of horn shape and hair color. Sheep and goats are so closely related that their



characteristics overlap. For example, the Barbary sheep closely resembles a goat, whereas, the blue sheep is actually a goat. Today genetic and tissue studies are becoming increasingly more important to correctly classify these animals.

Sheep, such as the bighorn sheep, have massive horns with a tight curl and forward pointing tips. Female sheep have



relatively smaller horns than female goats, and in some sheep species females have lost their horns entirely.

Sheep typically inhabit open ground close to cliffs to which they escape when pursued by a predator. They live in groups, decreasing chances of predation. Male sheep fight only for show with harmless clashing of heads.

Primitive goats, such as the mountain goat, have short straight horns with sharp tips. More advanced goats, such as the ibex, have long horns that arc backwards.

Goats are specialized for living on cliffs where the rough terrain protects them from predators. More primitive species, such as the mountain goat, live alone and are

territorial. They protect the resources they depend on. Their territorial battles are short, bloody, and rare, except when food is scarce. They do not clash heads when fighting.

More advanced goat species may resemble sheep in appearance and behavior. However, male goats have a beard; male sheep do not.

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Made To Order

QUESTION: What would you use to clear the snow from your driveway or sidewalk?

Read the following selection:

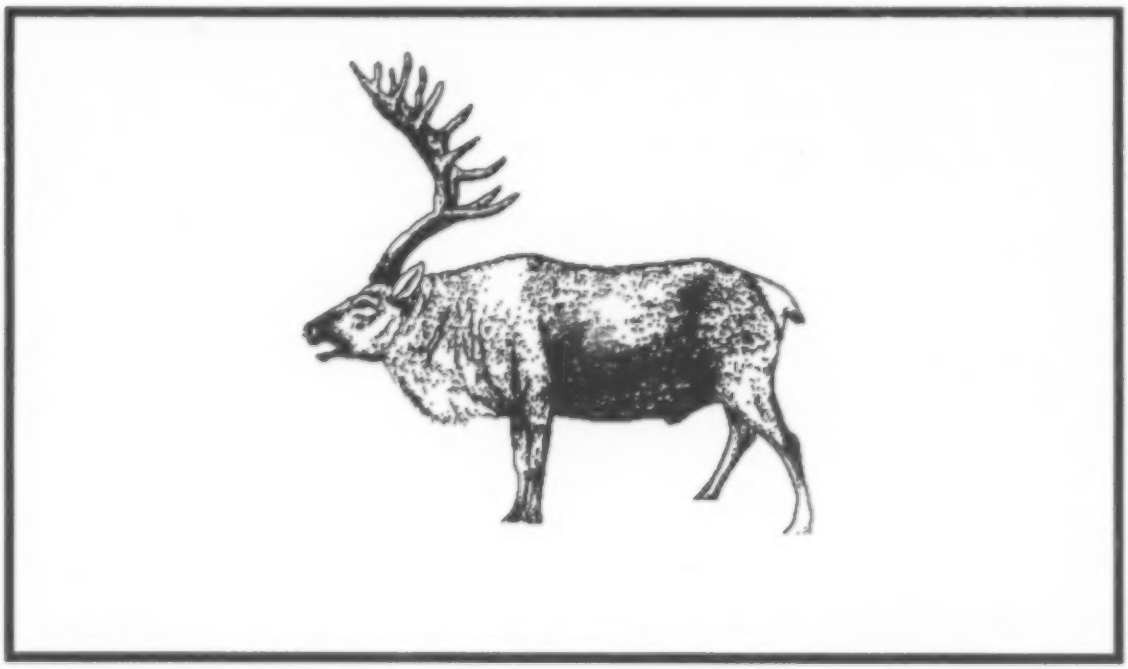
In cold climates people have snow shovels or snowblowers to clear away the snow. Caribou, or reindeer, also clear away snow to reach the lichens and mosses that they feed on in the winter. The bull caribou has developed a shovel-like tine on its antlers. This tine is over its brow and could be used to "shovel" away the deep snow to reach this food. It grows wider than the other tines and vertically, like a hand with the thumb turned upward. Sometimes both brow tines grow in this way.

Caribou are the only members of the deer family on which antlers grow on both the males and females. They have the largest antlers compared to the size of their bodies. Older males shed their antlers in December and young males do so toward spring. The females keep their antlers until early summer.

QUESTION: What would you need to walk in the deep snow without sinking?

Read the following selection.

Caribou do not have snowshoes. They do have wide cleft hoofs that make it easy for them to walk on soft, thawed tundra or deep snow. As the caribou walks, a tendon slips over a bone in the hoof, making a clicking sound. The plate-size hoofs help spread out the weight of the caribou and allow it to move through arctic conditions faster and more efficiently. If their hoofs were the size and shape of other deer, they would bog down in the soft ground or snow.



The caribou above is missing its brow tine, or shovel, and its hoofs. Draw in the missing adaptations the way you think they look. Check your drawing by finding a picture of a caribou.

Meet My Friends

Herby Voris

Carny Voris

Omny Voris

Herbs are plants and spices.

Herbivore

Carne is meat in Spanish.

Carnivore

Omni means all things.

Omnivore

List the animals that fit each category.

Draw your own animal. Is it a herbivore, carnivore, or omnivore? What does it eat?

Whose Feet?

Ape
Plantigrade

Cat
Digitigrade

Pig
Even-toed Ungulate

Horse
Odd-toed Ungulate

How an animal stands on its feet is an adaptation to the way it lives. The feet of most animals can be compared to our hands. Try holding your hands in these positions and imagine how the different animals walk or run.

Plantigrade	Digitigrade	Even-toed Ungulate	Odd-toed Ungulate
Put your hands flat on the table.	Put four fingers down but lift up the heel of your hand.	Put two middle fingers down and pull other fingers behind, but not touching the table.	Squeeze all four fingers together with just the tallest finger touching the table.

How Old Are You?

Birthdays are always fun. It is easy for you to tell someone how old you are. Have you ever thought about how to tell the age of an animal?

Biologists study herds of big game animals to determine the age of the animals. If there are many young animals, the herd is growing.

There are several ways to tell an animal's age. In the antelope family, looking at the teeth works quite well to determine age. The milk or baby teeth are replaced in a certain order much the same as your baby teeth. By looking at the number of baby teeth a biologist can tell the age. After an animal loses all of its baby teeth it is harder to tell the age.

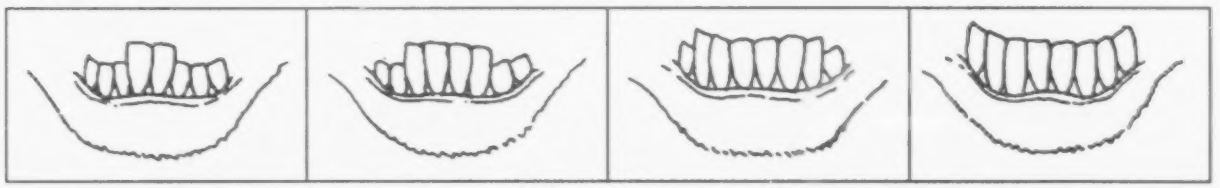
If a biologist needs to know how old an animal is after it has lost its baby teeth, a tooth is removed and sent to a lab. There it is soaked in a chemical to soften it. Then it is cut in thin slices. When examined through a microscope, a slice of tooth has circular rings like trees. The tooth makes a ring each winter when there is little food. By counting the rings, or winters, the biologist knows the animal's age.

Since birds don't have teeth, they are aged by feathers. If the last three long feathers on each wing are rounded, it is probably an adult. These flight feathers are called primaries. If they are short and pointy, the bird is probably young.

How old is an antelope?

An antelope is born with eight baby teeth in the front of its lower jaw. It loses two baby teeth and gains two permanent teeth every year for its first four years of life.

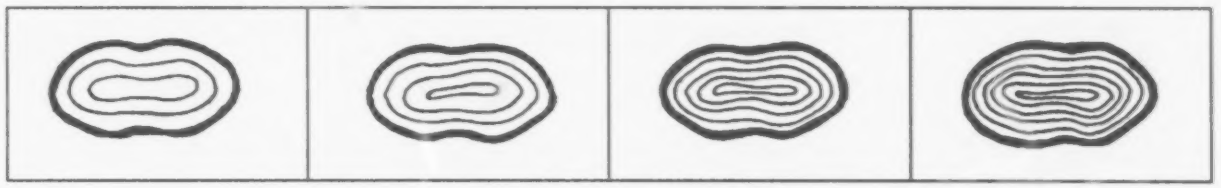
Count two permanent teeth for each year of this antelope's life. Write the age under each drawing.



_____ _____ _____ _____

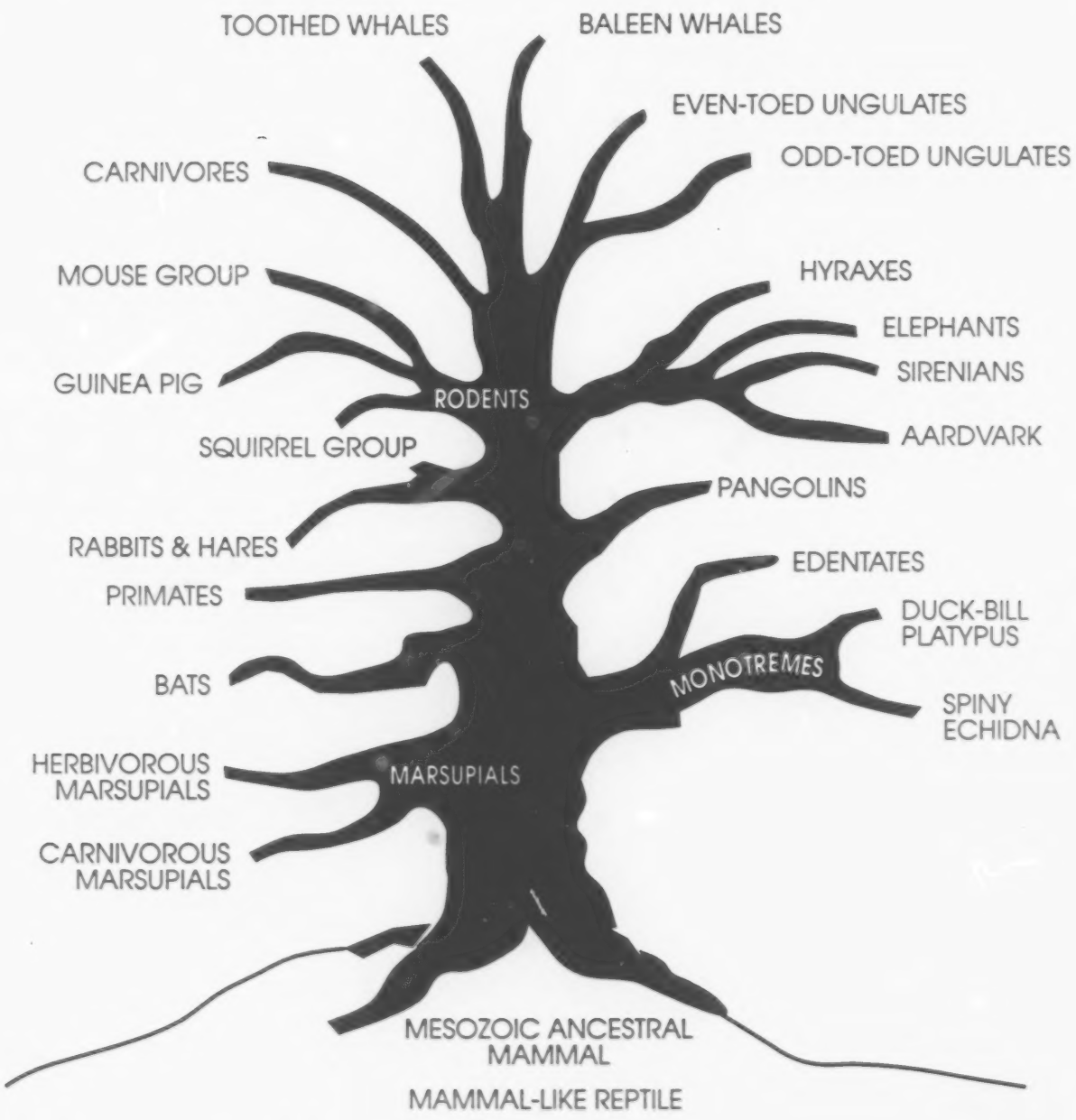
To correctly tell how old an animal is which has all eight permanent teeth, a tooth is removed and sent to a lab. There it is sliced and the rings counted.

Count the rings of each tooth slice below and write the antelope's age.



_____ _____ _____ _____

Family Tree of Mammals



Glossary

Those words and terms most often used in wildlife ecology or wildlife management are defined here in non-technical language with examples to be understood by laypersons, teachers and students. Many of these terms are not found in ordinary dictionaries, and most definitions are followed by examples and/or related words, to make it easier to understand their meaning. This glossary is also intended as an aid for students interested in careers in the field of wildlife ecology, research or natural resources management.

abiotic: without life, as an abiotic lake or environment containing only sterile water or soil and rocks consisting of minerals and chemicals; an abiotic environment may exist in nature where there is no life, or may be due to man-caused conditions in the environment such as acidic or alkaline conditions in the soil or water, toxic liquids or gases in the environment (see biotic, contamination).

acclimation: the physical and/or behavioral adjustments of an organism to changes in its immediate environment (see acclimatization, adaptation).

acclimatization: the acclimation or adaptation of a particular species over several generations to a marked change in the environment (see acclimation, adaptation).

acre: a unit of land equal to 4840 square yards or 43,560 square feet, originally determined by the amount of land a farmer could plow with one horse in a day, and used as a means of designating an estimated number of plants or animals (number per acre); currently being replaced by a more universally accepted metric term (see hectare).

acute toxicity: any poisonous effect produced within a short period of time, usually within one to three days resulting in severe impairment or death (see chronic toxicity).

adaptation: a process of adjusting behavior or developing certain unique physical features to better survive a harsh environment or for breeding purposes; for example rodents burrow to escape cold or heat; desert plants have spines (cacti) instead of leaves to reduce transpiration of water as an adaptation to extreme drouth, summer heat and winter cold; hummingbirds have evolved long bills and the ability to hover for feeding on nectar from deep-throated flowers; many male birds have evolved ornate plumage, an "adaptation" for attracting the female of the species (see behavior, camouflage, coloration).

adult: an animal that is sexually and physically mature, capable of breeding and producing young (see juvenile, immature).

altricial: helpless at birth or when hatched, as are human babies and most young birds (see precocial).

amphibian: a cold-blooded, smooth skinned, vertebrate species of wildlife including toads, frogs, salamanders and newts that spend all or a part of their lives in or near water, especially wetlands, marshes, usually starting life in water as eggs and juveniles (pollywogs or tadpoles) with gills, then changing into adults living on land but returning to water to reproduce; some amphibians live in or near water or the bottom of a pond their entire life "breathing" through the thin skin on their stomach while in hibernation or estivation, but developing lungs to become air-breathers when active on land (see estivation, hibernation, herpetologist).

annual: a plant that grows from seed each year, dies and comes up again, completing its life cycle in one year (see biennia, perennial).

aquatic: pertaining to water as aquatic wildlife living only in an aquatic habitat such as a lake, stream, river or ocean (see riparian, terrestrial, wetlands).

arthropods: includes the millions of species of animals without an internal skeleton or backbone referred to as "invertebrates", such as insects (ants and grasshoppers), spiders (arachnids), crustaceans (crayfish, lobsters), and myriapods (centipedes, millipedes).

arboreal: living in trees most of their lives, as do birds, monkeys, and many insects (see aquatic, habitat, terrestrial).

balance of nature: theoretically, the "balance" maintained between plant eaters (herbivores) and plants, and the predators and prey species which allows all living things within a "biotic community" to live in constant harmony with the environment; a true "balance" seldom exists at any one time in any given area (see carrying capacity, cycle, food chain, food web).

bed: a hollowed out place within a territory where an animal can feel secure; usually less elaborate than a nest or den, but a place out of the elements where an animal such as a deer or elk has good visibility and two or more "escape routes" from predators; can be on the side of a hill or in a dense stand of brush or trees; most animals have two or three alternate beds within their territory or home range (see den).

behavior: actions an animal performs in order to survive and reproduce as an adaptation to the environment (see courtship, display).

biennial: a plant that lives only 2 years, producing seeds the second year before dying (see annual, perennial).

big game: the larger hunted species of wildlife harvested by market or sport hunting, such as deer, elk, bear, lion, moose, bighorn sheep, etc. (see small game, game animal).

biologist: a person who studies living plants and animals; a biologist who studies plants is called a botanist and one who studies animals, a zoologist (see ecologist, mammologist, ornithologist).

biological control: method of controlling pests using natural methods such as parasites, predators, repellents, disease producing micro-organisms, and organic biocides instead of man-made chemicals (see balance of nature, predation, parasitism).

biome: the entire community of living organisms in a single major ecological region; a large area encompassing the largest ecosystems where plants and animals are basically developed as a result of long-term climatic conditions, such as arctic, temperate, or tropical, and may cover the largest part of a single continent (see biotic community, ecosystem, life zone).

biotic: living, or with life, such as a "biotic community" consisting of living organisms, plants and animals (see abiotic).

biotic community: an association of living plants and animals, each occupying a certain position or niche in a common environment and within the same ecosystem; a biotic community can be as large as the planet earth, or as small as that of a wolf spider's web so long as all of the habitat requirements are met for a particular association of organisms (see biome, environment, habitat, life zone).

birds: the most abundant vertebrate species of warm-blooded animals, bearing feathers and reproducing from eggs, most of which have the ability to fly (see amphibians, fish, mammals, reptiles).

birth rate: the rate of reproduction of an animal; number of births of a species of animal in a given amount of time; usually expressed as "average annual birth rate" or average number of young per year by a pair of animals (see survival rate, mortality).

botanist: a biologist who studies plants; botany is the study of plants (see biologist, ecologist, zoologist).

browse: woody-stemmed shrubs that are commonly used by herbivores, such as rabbits, deer, moose and elk; often erroneously referred to as "buckbrush"; "to browse" means to feed on the leaves, twigs and stems of shrubs (see grass, graze).

burrow: underground den excavated by burrowing animals who live a portion of their lives underground, ie. gophers, many rodents, rabbits and badgers; an adaptation to meet survival requirements of certain animals to protect them from the elements and/or other animals (see den, nest, territory).

camouflage: a means of concealment by protective coloration, especially to distort the appearance of the body outline to blend with the background of a natural habitat and confuse a potential enemy (see adaptation, coloration)

carnivore: an animal that eats meat, usually one that preys on other animals; a predator, such as lion, hawk, or owl (see herbivore, insectivore, omnivore, scavenger).

carrion: the body of a dead animal, usually not "fresh" meat but in the process of decay (see scavengers).

carrying capacity: the maximum number of animals a given area can support, ie. the number of deer per square mile in a particular habitat, or number of rodents per acre in a forest meadow; each kind of habitat has a specific "carrying capacity" for a given species or several species of animals and is dependent on the quantity and quality of food, water, and shelter (cover) available, and the proper arrangement of these in a given space (see habitat, limiting factors, social limits).

census: a survey to determine the number of animals in a given area; "direct census" made by actual observation of animals, "indirect census" made by observing amount of tracks, feces, calls, or other evidence of animals present (see inventory).

chaparral: a semi-arid biotic community consisting of a dense growth of tangled, often thorny shrubs, with very little grass and only a few trees, generally occuring on relatively rocky soil and steep topography.

chronic toxicity: effects of poison marked by a long duration of many months or years (see acute toxicity).

climax vegetation: the highest ecological biotic community an area will attain many years after a cataclysmic natural event such as flood, fire or die-off from drouth or disease, eg. forest, grassland, desert (see succession).

cold-blooded: "ectothermic" -having a body temperature that is dependent upon and varies with the temperature of the surrounding environment, as with reptiles and amphibians (see warm-blooded).

coloration: visual appearance or pigmentation of skin, feathers or fur which is inherited from parents and is usually determined through adaptation to blend with an animal's background or in the case of many birds and insects, serves to attract a mate or to lure a predator away from its nest or young and advertise a male's presence or territory to rival males; can range from drab brown or gray to a brilliant red, yellow or blue; coloration can also be attributed to physical structures instead of pigmentation which bend the light rays and often produce iridescent colors (see camouflage, courtship).

commensalism: a cooperative relationship between two or more organisms living in close proximity in which all may benefit but none are parasitic or dependent on the others (see competition, parasite, symbiosis).

competition: the behavior that results when two or more organisms attempt to fill the same niche or use the same resources (see commensalism, parasite, symbiosis).

cooperation: when two or more organisms fill the same niche or use the same habitat, each one enhances the existence of the other (see commensalism, competition, symbiosis).

conservation: the wise or best use of a natural resource in a way that will assure the availability of that resource for the future (see preservation).

contamination: pollution by contact or mixture; introduction of a foreign material, usually harmful, into the environment (air, water, or soil), which may eventually impacts wildlife and human life (see environmental impact, pollution).

courser: a predator who persues prey over a long distance, wearing the prey animals down until one falls behind and becomes vulnerable; most wild dogs, coyotes and wolves are coursers (see stalker).

courtship: behavior during breeding season to entice the opposite sex for purposes of breeding and propagation of the species (see coloration, courtship).

cover: a "covert" or "shelter" formed of vegetation, piles of debris or rocks to provide concealment for sleeping, feeding, breeding, giving birth, or escaping from enemies (see habitat).

crepuscular: active mostly at dawn or dusk (see diurnal, nocturnal).

cycle: the increases and decreases in a natural population of plants or animals which occur with a certain regularity, determined by genetic or environmental factors and is either "normal" as in snowshoe hares in Canada, or "irruptive" as with Gambel's quail in Arizona (see balance of nature).

death: the cessation of life - a condition that all living things eventually assume; plants die from being eaten by animals or from old age (decadence); animals die from starvation, hunting, accidents, predation, parasites, the elements (snow, rain, cold, heat, etc.), or disease, all of which can be brought on by a loss of habitat (see decadent, habitat, mortality rate).

decadent: old age, when a plant or animal becomes too old to function as a vital part of the ecosystem; plants can become decadent when not utilized by animals; animals become decadent when they become sedentary through lack of vitality, competition, exercise etc. which usually occurs in old age (see death, mortality rate).

den: a wild animal's shelter or lair; usually that of a predator or other species that builds or digs a place to have young, ie. bear, lion, coyote den etc. (see bed, habitat, shelter, territory).

desert: an arid or semi-arid biotic community where plants and animals are relatively sparse and have adapted to less than 10 inches of average rainfall per year (see forest, grassland, chaparral).

diurnal: active during the daytime (see crepuscular, nocturnal).

diversity: as used in the context, "biotic diversity", referring to a variety of plants and animals; the diversity of plantlife and habitat is indicative of the variety of animals to be found in a given area.

dominant species: plant or animal species which exist in greater numbers or exert major influence on the biotic community (see key species).

domesticated: animals which humans have tamed over many years, to be kept in captivity, bred and used for their own special purposes, ie. dogs, cats, cows, horses etc. (see feral, wild, wildlife).

ecological niche: that special place in a biotic community or given ecosystem occupied by a plant or animal; where it lives, feeds, and finds shelter; the social affiliations (friends and enemies); what the plant or animal contributes to or receives from the biotic community, the affect it has and how it is affected by the natural environment, what it does to survive and reproduce, the "lifestyle" of a plant or animal (see food web).

ecologist: a biologist who studies the relationship between plants and animals with each other and their environment; a scientist who studies ecosystems (see biologist, ecology, ecosystem).

ecology: the study of the relationship of plants and animals with each other and their environment; "ecos" is Greek for "home" and "ology" is Greek for "the study of"; ecology is often erroneously used in place of "ecosystem"; we cannot damage the "ecology" but we can cause damage to the "ecosystem" (see biology, ecologist, ecosystem).

ecosystem: an area of any given size in which all plants, animals and microbes exist with their environment as a relatively self-sustaining unit independent of any other ecosystem; a micro-ecosystem may be as small as a colony of microbes, and a macro-ecosystem may include an entire forest so long as the system is self sustaining; the entire earth could be considered an ecosystem within the larger universe (see biotic community, ecology).

endangered: a species of plant or animal in danger of becoming extinct throughout a significant portion or all of its range, often for several reasons but usually due to the loss of habitat or drastic changes in the ecosystem (see extinct, threatened, rare)

endemic: native to a given area, existing since prehistoric times (see exotic).

energy cycle: the motivating force that "drives" the food chain starting with the sun from which all energy originates, to plants, animals and returning to soil as decomposition in which energy in the form of heat is finally expended (see life cycle, food chain).

entomologist: a biologist who specializes in entomology - the scientific study of insects (see herpetology, ichthyology, mammology, ornithology, zoology).

environment: the total abiotic (physical) and biotic (living) surroundings: climate, air, water, rocks and soil, location and topography; includes plants and animals that constitute many individual habitats; including human civilization and the changes made by humans; the sum of all external conditions and influences affecting the life, development, and ultimately, the survival of all organisms (see genetic, habitat, ecosystem).

environmental education: simply stated, learning about the environment is, in its broadest sense means learning about everything that affects our lifestyle and existence that is not inherited from our parents, and because the environment in ubiquitous and omnipotent: in a sense, "all education is environmental" and a study of the effects of the environment on other animals, including wild animals, is to study the environmental effects on humans.

environmental impact: a natural or man-caused disturbance in the environment or ecosystem that significantly influences or affects the quality of life of organisms, especially humans, as most animals do not have the ability to realize their environment has been "impacted", but simply react to the change, or disappear from the ecosystem (see contamination, endangered, threatened, extinct)

environmental impact statement: a document prepared by an agency of the government or private consultant on a given environmental impact of a certain human activity or development, and options to minimize, overcome or mitigate the impact as required by the National Environmental Policy Act (NEPA) and enforced by the Environmental Protection Administration (EPA).

environmentalist: an activist who is concerned about the environment.

estivation: the opposite of "hibernation"; when animals burrow into the soil, den-up in rocks or seek shade to escape the summer heat; an adaptive behavior to help survive the hot desert areas of the world (see hibernation).

exotic: not native to an area; a foreign plant or animal from another ecosystem or continent (see endemic).

extinct: no longer existing such as the passenger pigeon and dinosaurs that have disappeared from the planet: No longer active, as an "extinct" volcano (see rare, endangered).

feather: the pelage of birds including down, coverts and flight feathers.

feces: the excrement of animals usually refered to as "scat" for predators and "droppings" for herbivorous animals; feces provide an excellent source of indirect census of a given number of animals in an area; fecal analysis can also tell us what animals eat.

feral: domesticated animals that have gone wild and succeeded in surviving and reproducing in the wild, such as urban pigeons, wild burros and horses (see wild, domesticated)

food chain: the organisms involved in the transfer of energy beginning with the sun (plus soil and water), through plants and a series of animals (herbivores), to meat eaters (carnivores) and animals that eat both plants and other animals (omnivores). Sometimes referred to as the energy chain where different "trophic levels" of energy are involved from the primary producers (green plants) to consumers (animals). An example is a green plant eaten by an insect (herbivore), which is eaten by an insect-eating bird (insectivore), which is in turn eaten by a larger bird (raptor) or mammal (see food web, predator, prey).

food pyramid: a pyramid diagram that represents many food chains and webs beginning with plants at the base of the pyramid and progressing upward through different trophic (energy) levels, decreasing in number of animals at each level of herbivores, carnivores, omnivores and finally reaching the top predator or consumer. In many diagrams humans are the "ultimate" predator or consumer (see food chain, food web).

food web: an interlocking pattern of food chains beginning with soil and plants, many different plant eaters (herbivores), a few meat eaters (carnivores), and even fewer animals that eat both (omnivores) which includes bears and humans (see food pyramid, food chain).

forage: herbaceous vegetation - grasses, forbs, shrubs, and the leaves and twigs of trees consumed by herbivores (cows, sheep, elk, deer, bison etc.); forage crops are those that are fed to domesticated animals and include alfalfa, various grasses, corn, milo and other ensilage grown by farmers to feed livestock; to forage means to eat herbaceous plants (see browse, herbivore).

forbs: mostly broad-leaved plants without woody stems, as opposed to shrubs and grasses; most forbs are considered weeds, have flowers, produce seeds and are important wildlife food (see grass, shrubs, weeds)

forest: a biotic community of plants and animals where trees are the predominant or key species (see biotic community, tree)

game animal: wildlife that may be hunted only by restricted seasons and laws; an animal raised on a game farm (see big game, small game)

game farms: ranches or farms where wild game animals are raised for sport hunting and/or commercial harvesting (instead of domestic livestock) for market or restaurant trade (see sport and market hunting).

genetic: of or relating to origin of living reproductive cells particularly genes and chromosomes of plants and animals that will determine the inherited characteristics of the progeny of a species; the primary internal determinant of what an animal or plant will be at maturity as opposed to environmental influence (see environment, heredity).

grass: annual or perennial plants typified by linear leaves and the lack of a single central stem, usually made up of many round, hollow stems that contain green flower-like structures (florets) at the end of seed stalks, grasses usually lack showy colored flowers as in other plants but sometimes have ornamental seed heads as in fountain grass: Grain crops such as oats, rye and wheat are valuable grasses that have been domesticated by humans (see forage, graze, forbs, shrubs, weeds).

grassland: a biotic community where the predominant species of plant is grass, and most of the animals are "grazers" such as bison, horses and cattle; often referred to as "rangeland" (see climax vegetation, rangeland, marsh, meadow).

graze: to feed primarily on grasses, such as bison, cows and horses whose diet consists primarily of grasses and forbs (see browse).

habitat: the home or place where an animal lives; the requirements of a habitat include all things every animal must have to survive: food, water, shelter or cover, a space to move about and carry on necessary activities for survival, and the proper arrangement of these features. An aquatic habitat can be as big as an ocean lagoon for whales or as small as a rain-water puddle for mosquito larvae (see ecosystem, environment, niche).

harvest: collecting or taking of plants or animals (including fish) for man's use with the expectation that they will usually reproduce and reach carrying capacity the next breeding season; the harvest of big game animals is a necessary part of wildlife management in order to prevent over-population and eventual long term depletion of the food supply and potential permanent habitat destruction, as when overgrazing or excessive cultivation of crops results in the loss of top soil (see carrying capacity, game farm, hunting).

hectare: the metric unit of land measuring 100 meters X 100 meters or 10,000 square meters or 2.477 acres; the universally accepted unit of measure in wildlife management, as in estimating number of animals per hectare (see acre).

herb: a relatively succulent plant that is suitable as forage for wildlife and livestock, including grasses, forbs, and leaves of shrubs and trees (see herbivore).

herbicide: a chemical that kills plants (see pesticide).

herbivore: a plant eater; an animal that survives entirely on herbaceous forage; ie. cows, deer, rabbits, elk, squirrels, bison (see carnivore, omnivore).

heredity: the genetic passage of physical and behavioral traits and attributes from parents to offspring via genes and chromosomes; the only other influence or factor that determines a plant or animal's characteristics besides the environment (see genetic).

herpetologist: a biologist who specializes in herpetology - the study of reptiles and amphibians (see ichthyoligist, mammologist, ornithologist, zoologist).

hibernation: passing the winter or a portion of it in a state of deep sleep, as bears, marmots and other northern species do when they cannot migrate to a milder climate and food becomes unavailable (see estivation, migration).

home range: the area a non-migratory animal inhabits in order to locate food, water, shelter, and others of its kind for breeding purposes and survival, the home range of a migratory animal may be considered the entire winter and summer habitat (see habitat, territory).

humus: the soft decaying plant material that eventually forms organic soil, providing a seed bed for plants to germinate and grow; a part of the top-soil sometimes refered to as decayed "litter" or "duff."

hunter: an animal or predator who searches for and pursues a prey animal with the intent of catching or killing it; includes humans who assume the role of a predator (see predator, prey).

immature: a young animal, usually full grown, but not sexually mature, between the juvenile and older adult stage (see juvenile, adult).

indigenous: naturally occurring or native to a locality, such as "indigenous" species of plants and animals (see endemic, exotic, native).

influences: conditions in the environment or habitat that lead to the indirect loss or reduction of wildlife populations, such as long periods of cold weather or heat and drouth that weaken animals and expose them to direct factors of mortality (see limiting factors).

inorganic: non-living and non-renewable resources such as air, water, and metallic (iron, copper, gold silver) and non metallic minerals; rocks, silt, sand and components of the soil that have never existed as a living plant or animal, but could have been a component of a living cell (see organic).

insect: an arthropod with a three-segmented body (head, thorax, abdomen), three pairs of leg, and usually flies, often with two pairs of wings, the most abundant wildlife on earth (see arthropod).

insectivore: a plant or animal that eats insects (see predator).

insecticide: a chemical developed specifically to kill insects (see herbicide, pesticide).

integrated pest management: a system of controlling pests by using natural, biological,

cultural, or chemical means to minimize the impact to other animals and the environment (see parasite, herbicide, pesticide).

interaction: the relationship of one organism to another; the action of one population of animals affecting the growth or death rate of another population; ie. the interaction of deer and elk, or elk and livestock (see competition, commensalism, cooperation, symbiosis).

interdependent: the dependence of two species upon each other and their environment (see ecology, interaction, symbiosis).

invade: the movement of one species of plant or animal into another's biotic community; an exotic species in a new community, usually as the result of a similar species dying out or becoming extinct.

inventory: the process of surveying, counting, and classifying plants or animals in an area to determine size of population, sex and age ratios and general health of the population (see census, survey).

invertebrates: animals without backbones, including arthropods (insects, spiders etc.) and millions of small organisms in the soil (earthworms) and aquatic environments (jellyfish, sponges, sea urchins) (see arthropods, vertebrates).

juvenile: an animal that is not sexually and physically mature, usually less than one year old (see adult, immature).

key species: a species of plant which is important a given biotic community, often predominant or very abundant, usually referred to as a "key plant species" but not always a "native" or "endemic" species (see dominant species).

license: a legal permit which allows the holder to fish, hunt, trap, or otherwise possess or transport wildlife, or perform taxidermy (see hunter, taxidermy).

life cycle: the continuous sequence of biologic changes that occur from fertilization of a plant or animal to maturation, and propagation of another individual of the same species where death is coincidental but not the end result (see energy cycle, life history).

life history: the sequence of development of an individual plant or animal from the beginning of life, to maturation and old age, resulting in death (see life cycle).

life zone: a relatively small biotic community such as seen on the slope of a mountain where the biotic community of plants and animals changes from lower to higher elevations but live under a similar climate; may differ slightly from adjacent biotic communities within the same biome by possessing different subspecies of plants and animals; (see biome, biotic community, ecosystem).

limiting factors: conditions in the habitat or environment that are a direct cause of death or that curtail the growth of a healthy population of plants or animals, such as a sudden lack of food, water or shelter, or the advent of conditions of natural mortality, such as sudden storms, accidents, disease, predation etc. (see influences, mortality rate).

litter: the number of young born per birthing, usually referred to as the average litter size in mammals; also the dead organic ground cover (wood, leaves, grass etc.) that will absorb the effect of raindrops, thus protecting the soil beneath as a seedbed for germination, often referred to as "duff" on a forest floor, changing to humus when decay begins (see humus).

mammal: warm-blooded animals with backbones, hair, and nourishing young on milk secreted by mammary glands; includes humans, deer, rabbits, seals, whales, etc. (see amphibians, birds, fish, reptiles, vertebrates).

mammalogist: a biologist who specializes in studying mammals (see herpetologist, ichthyologist, entomologist, ornithologist, zoologist).

market hunting: the harvesting of game animals from the wild for commercial purposes to sell in markets or restaurants for human consumption, no longer legal in most developed countries except in game farms and fish farms where wildlife is raised for commercial purposes (see game farms, sport hunting).

marsh: a wet, swampy area where sedges and rushes grow as opposed to grasses and shrubs; the stage in natural succession between a pond and a wet meadow; a wetland, often referred to in the west as "cienega" (Spanish), an important habitat for many species of wildlife, especially waterfowl, amphibians and fish (see aquatic, grassland, meadow, riparian, wetland).

meadow: an area of grass that is frequently flooded after winter snow or summer rains; was formerly a pond and then a marsh in the natural succession of vegetation, may eventually become a dry upland

grassland or forest; predominantly composed of sedges and moisture tolerant grasses (see grassland, marsh, succession).

migration: the periodic movement, either locally as up and down a mountain, or over long distances from north to south as with most species of waterfowl, shorebirds and many songbirds, for the purpose of escaping inclement weather conditions, to assure a continuous food supply, and to complete their life cycle (see migratory wildlife, resident wildlife).

migratory wildlife: animals that periodically move over long distances, from northern areas to southern areas in the fall, returning again in spring such as migratory bird species (ducks, geese, shorebirds, doves, warblers, hummingbirds, etc.) and mammals, (esp. whales, caribou etc.); local migrations from higher mountain elevations to lower elevations and returning as the seasons change (deer, elk). Most of these species have well established migration routes; other animals hibernate or estivate instead of migrating (see hibernate, estivate).

mortality rate: the death rate in a given population of animals, usually represented in number of deaths per thousand animals; usually highest in young animals immediately after birth or within the first year of life, and second highest in old age (see birth rate, natural mortality, population dynamics).

multiple use: a management practice or system involving the utilization of the natural resources of a given area of land or water for a variety of purposes such as camping, hiking, hunting, grazing, timber harvest, etc.

natal: pertaining to birth or accompanying the birth of young such as "natal disease" or "natal mortality."

native: occuring naturally in a given area since prehistoric times; native plants and animals are "endemic" or "indigenous" (see exotic).

natural mortality: also natural attrition; death of an animal or plant due to natural factors, not caused by man, but resulting in a decrease in the population (see mortality rate, population dynamics).

natural resource: that portion of the environment upon which people have placed an assigned value; anything in or on the earth which is not made by man but of which all things are manufactured; renewable natural resources include living things, ie. trees, grasses, and wildlife (see non-renewable).

natural resources management: as related to wildlife, the artificial manipulation of habitat, animal numbers, and harvest of game animals to increase their numbers or to maintain a healthy population; the purpose of management is to attain the long-term benefit for an optimum number of species in a wild population (see conservation, preservation, research).

natural selection: the process in nature resulting in the survival and perpetuation of only those forms of plant and animal life having certain favorable characteristics that enable them to adapt best to a specific environment and compete effectively with other animals; commonly referred to as the "survival of the fittest" (see adaptation, survival rate).

niche: the place where a given species of plant or animal "fits" into the ecosystem with other plants and animals, based primarily on "what it eats, and what eats it" (see habitat, interaction).

nocturnal: normally active at night, as are foxes, owls, skunks (see diurnal, crepuscular).

nongame: the majority of wildlife not normally hunted, killed or eaten by humans, such as songbirds, raptors, reptiles, amphibians and small mammals; includes all legally protected wildlife (see game animals, endangered, threatened).

nonrenewable natural resource: nonliving natural resources such as rocks and minerals which do not regenerate themselves; metallic minerals such as iron, copper, gold and aluminum which can be recycled; fossil fuels (esp. coal and oil) are non-recyclable when consumed for energy production; once all nonrenewable and non-recycleable natural resources are removed from the earth, they are gone forever and are therefore finite (see renewable natural resources).

nutrients: elements or compounds essential as raw materials for the growth and reproduction of plants and animals, such as carbon, oxygen, nitrogen, and phosphorus (see inorganic, limiting factor, organic).

old growth: currently referring to "old growth forests" which have never been harvested; virgin forests where most trees are very large and mature, offering a special habitat to a few select species of wildlife such as the hermit thrush, red squirrel, and spotted owl (see endangered, threatened, forest).

omnivore: an animal that eats both plants and animals such as a black bear, human, or domestic swine. Other animals such as coyotes and skunks can and do eat plant material when necessary to survive but are primarily meat eaters (see herbivore, carnivore, insectivore, scavenger).

organic: organisms that are composed of living cells, ie. plants and animals; also dead, decomposed material that was once living; composed mostly of carbon compounds (see inorganic, humus).

organism: a living plant or animal; a form of life composed of mutually dependent parts that maintain various vital processes (see organic, species).

ornithologist: a zoologist who specializes in the study of birds (see biologist, herpetologist, mammalogist).

parasite: an organism that derives benefit from and is usually totally dependent on another organism for survival, often weakening or harming the "host" animal in such a way that death is often the final result (see commensalism, symbiosis).

pelage: the body covering or hide, such as hair, feathers, or fur of a warm-blooded animal.

perennial: a plant that lives for several years or more, producing seed each year or reproducing vegetatively from roots or joints in the stems (see annual, biennial).

pesticide: an agent used to control pests; any toxic chemical formulated to kill pests in the home and on agricultural crops; includes herbicides (weeds), fungicides (fungi), rodenticides (rodents), germicides (germs) insecticides (insects), etc. Rresidual pesticides remain in the environment and can contaminate "higher" organisms that eat vegetation and animals that have been contaminated with long-lasting pesticides. Certain pesticides such as DDT have been shown to interfere with reproductive processes of predatory birds and other animals (see biological control, insecticide, integrated pest management, herbicide).

pinch period: the period during the annual life cycle of a plant or animal when the factors for continued survival are least favorable (see limiting factors).

phytoplankton: the plants that exist as plankton in oceans and lakes, forming the basis of marine and freshwater food chains essential to growth of higher aquatic organisms, especially crustaceans and fish (see plankton, zooplankton).

plankton: minute, sometimes microscopic, floating plants or swimming animals in freshwater or saltwater which provide the higher forms of animals a food source in the food chain (see food chain, phytoplankton, zooplankton).

poaching: the act of taking wildlife illegally, seldom during hunting season and in violation of game and fish laws; a person who poaches is called a "poacher" and is a criminal, sometimes in violation of both state and federal laws and usually subject to a heavy fine and imprisonment (see license, season, hunter).

pollution: toxic or otherwise harmful substances deposited in the air, water or in the soil that create an unhealthy environment for living organisms including wildlife and humans; a condition in the environment that can cause undesired environmental effects such as disease, disability, or premature death (see acute and chronic toxicity, contamination).

population: the total number of individuals of one species of wildlife in a given area, usually designated by the number of animals per acre, hectare, or section (see carrying capacity, limiting factors, survival rate).

population dynamics: related to the active change or fluctuation in numbers of individuals in a population of organisms. This occurs usually as a result of drastic changes in climatic conditions or by disease, characterized by high mortality and reproduction rates; also caused by mass migration or movement into or from an area. Small animal populations are usually more dynamic; large animal populations are generally more static (see birth rate, carrying capacity, mortality rate).

precocial: animals that are active at birth or when hatched, able to "take care of themselves" such as jackrabbits and quail (see altricial).

predaceous: a plant or animal that exhibits the behavior of a predator (see carnivore, insectivore, predator).

predator: an animal that pursues, kills and eats other animals; also plants that passively capture insects and small animals that happen to fall into their "trap" (see carnivore, coursers, insectivore, stalkers).

preservation: the storing away of resources in which there is virtually no managment, and utilization of those resources is minimal (see preserve, refuge or wilderness)

preserve: in wildlife management the term used for a given area of land where wildlife are given highest priority and where hunting of game is permitted only when necessary to keep wildlife from overpopulating and creating a problem for the survival of the entire species (see refuge).

prey: animals that are killed and eaten by predators. Prey species are usually herbivores (plant eaters) but can be another predator when pursued by a larger predator; many small predators often live as both predators and prey species (see food chain, predators).

rangeland: an area of land, predominantly mixed grassland, praire or plains where mostly grazing animals, ie. cattle, sheep, antelope and bison, can utilize the resource (see forest, grassland, habitat).

raptor: a bird of prey; a predaceous bird, ie. eagle, hawk, osprey or owl, equipped with talons and hooked upper beak, adaptations for killing and eating other birds, small mammals, fish and reptiles (see predator).

rare: animals that probably never were abundant due to their specific habitat requirements, low reproduction rate, social intolerance or all three (see threatened, endangered).

recovery plan: a plan required by the Endangered Species Act to attempt to re-establish an endangered species or one that is locally extinct (see endangered, extinct, rare, threatened).

recycle: to use again in its present form, or in a different form. Water is a natural resource that can be used again and again as demonstrated by the "water cycle"; carbon, nitrogen and many other natural products of the earth can be recycled; many nonrenewable natural resources such as iron, aluminum, gold, silver and copper can be recycled or re-manufactured as another product from remains of the original product (see renewable and non-renewable natural resources).

refuge: an area where wildlife is given first priority and hunting is not permitted unless, as a last resort, it will benefit the wildlife in some way, possibly by reducing an overpopulation or culling the flock or herd (see preserve, wilderness).

reintroduction (of a species): a tool of wildlife management whereby a species of wildlife is introduced into an historic habitat from which it has been eliminated. Modern methods of capture and release have made it feasible to reintroduce many species from zoos, game farms and more densely populated areas into suitable habitats (see recovery plan, stocking).

renewable natural resource: a living, reproducing resource such as plants and animals that have the capacity for propagation in an area that is favorable to their continued survival (see non-renewable natural resource, recycle).

research: "pure" wildlife research is the work of a biologist in the laboratory or field to elucidate biological and ecological facts about a given animal or population without regard to human objectives; "applied" wildlife research is directed toward the management of a species to serve human needs as well as the needs of the animal (see wildlife management).

reptile: a "cold-blooded", usually egg-laying vertebrate having an outer covering of scales or horny plates, such as snakes, lizards, turtles or tortoises (see cold-blooded, bird, fish, mammal, vertebrate species).

resident wildlife: nonmigratory wild animals that are native to a particular area and reside in that area the entire year, seldom moving beyond the boundaries of their home range, then only in times of duress or hardship (see home range, migratory species).

riparian: the area that is a part of, or adjacent to a stream, river, wash or other waterway, where a source of water creates vegetation that is significantly different than the vegetation of the more arid surroundings; an important habitat for wildlife, especially in the arid parts of the world (see aquatic, wetlands).

riparian rights: "natural prior rights" of a land owner to the water on, or bordering his property, including the right to prevent diversion or misuse of upstream waters; a legal term that guarantees to downstream users clean, unpolluted waters (see riparian).

savanna: a relatively flat, largely treeless semi-arid grassland typical of central Africa (see grassland, rangeland).

section: one square mile of land, 640 acres in size, often used to describe larger expanses of land, such as deserts, forests and rangelands, and to delineate the relative size of a population of animals, eg. 10 deer per section (see acre, carrying capacity, hectare).

scavenger: an animal that eats the flesh of other dead and decaying animals. Vultures and skunks are typical scavengers, and sometimes bears, eagles, and coyotes will scavenge if dead animals or carcasses are readily available along highways or where die-offs have occurred (see carnivore, carrion, natural mortality, omnivore, predator).

scrub: a small broad-leaved shrubby plant with a woody stem; any collective group of woody-stemmed plants less than ten feet tall. Some trees such as mesquite and oak are "facultative", as they can exist as a scrub, or grow to tree size if adequate water is present; scrub live oak, manzanita and other hardy shrubs are a predominant part of many arid biotic communities (see chaparral, desert).

season: the time of year for something to occur, as the four seasons: spring, summer, fall, and winter; also the time of year for hunting (usually in the fall), trapping (winter months), and fishing season (spring and summer); also the "growing season" for plants (usually spring and summer).

shelter: sometimes referred to as "cover" (pl.) or "covert" (sngl.); protective vegetation, logs, rocks or physical features of topography where animals can seek refuge from enemies, have their young, feed, breed, beddown, or travel unseen by enemies from bedding grounds to feeding areas; an important requirement of all habitat along with food water, space, and arrangement (see cover, habitat).

small game: the smaller species of wildlife taken by sport hunting such as rabbits, quail, squirrels, woodchucks, and migratory species such as doves and waterfowl (see big game, game animal, migratory, resident).

snag: an old dead tree, missing most of its branches but still providing cavities for nesting birds and other animal dens; considered an extremely important habitat for more than half of the wildlife in the forest (see old growth forest).

social limits: the saturation point of a given number of wildlife species, in a given area dependent on their social tolerance (or intolerance) of other members of their species or a similar species beyond which fighting and competition reduces their numbers. Many predators are socially intolerant whereas herbivores often travel in herds and exhibit a great amount of social tolerance; social limits can restrict severely the number of predators in a given territory, regardless of the quality of the habitat and amount of prey species available (see carrying capacity, territory, home range).

species: a population of plants or animals that are genetically and morphologically "alike", will interbreed and produce fertile offspring under natural conditions (see endangered, heredity, subspecies).

specimen: an individual plant or animal, scientifically mounted, preserved and catalogued into a "collection" to represent others of its kind for taxonomic study; not particularly lifelike in form (see taxidermist).

sport hunting: the term applied to the controlled taking of big or small game animals by legal weapons during certain seasons so as to assure enough mature animals for reproduction during the next breeding season; (see market hunting, poaching, subsistence hunting),

stalker: a predator that sneaks up on its prey or waits in hiding until the prey is close enough for the predator to rush in and make a sudden kill; most cats and human hunters are stalkers (see courser, predator).

static population: a stationary number of animals in a given area indicating the population has reached "carrying capacity"; ie. a desert mule deer population may become static at 5 adults per square mile as determined by habitat conditions (see carrying capacity, census, inventory, population dynamics).

stewardship: the concept of responsible caretaking, based on the premise that humans do not own the natural resources but are simply managing the resources for the benefit of future generations in the belief that "we do not inherit the earth from our fathers; we borrow it from our children."

stocking: the artificial introduction of wildlife such as game birds or fish into a habitat or lake, generally in advance of hunting or fishing season to provide recreation for a short period of time with little expectation of establishing a permanent population (see reintroduction, transplant).

stress: physical or social pressure exerted on an individual or group of animals from the environment (storms, heat, etc.) or from other animals, i.e. predators, or animals of the same species, e.g. males during the breeding season (see limiting factors, social limits).

subsistence hunting: the hunting of wildlife by primitive people or natives in certain remote areas and countries where hunting is considered a birthright and a necessity for human survival (see game farms, market hunting, sport hunting).

subspecies: an organism that will freely interbreed with the same kind, including another subspecies, genetically identical to other members of that species with minor differences in behavior, morphology, or physiology, and usually having evolved in a geographically isolated area from others of its own kind. Most species have many subspecies, as they are distributed over a large area such as the several subspecies of North American bighorn sheep, mule deer, white-tailed deer, caribou, elk, etc.; some subspecies such as the Florida key deer and panther are endangered, whereas their subspecies in the rest of the U.S. are abundant; subspecies of plants are also referred to as a "variety" and are usually artificially propagated (see endangered species).

succession: the gradual and continuous change in plants and animals after a flood, fire or other catastrophic event during the time in which the habitat will gradually return to the original historic condition or highest ecological biotic community; stages in the vegetative development from bare ground to annual weeds and grasses, to climax grassland or forest, depending on the soil and climate (see climax vegetation).

survey: a method of inventory or census of plants or animals in a wildlife population (see census, inventory).

survival rate: the number of young animals (or plants) that survive their first year of life, usually reported as "percent of young" in the population, or more commonly as a ratio of Young per Adult (see birth rate, natural mortality).

symbiosis: a close living relationship between two species where the benefit is mutual and synergistic (see commensalism, interaction, parasitism).

taxidermist: one who specializes in taxidermy - the art of mounting wildlife specimens in lifelike situations so as to resemble the living animal. As with any professional artist, taxidermists must have a talent for their work plus years of training and practice (see specimen).

terrestrial: a ground dweller, living on land as opposed to living in water or trees (see aquatic, arboreal).

territory: the most intimate part of an animal's home range; the "comfort zone" immediately surrounding the den or the nest, where breeding and the raising of young usually take place; that small area that is fiercely defended against all other animals, especially those of the same species and the place where the parents will often give their life to defend their own life or lives of their mate or young; similar to the home or bedroom of a human family (see den, home range, nest).

threatened species: one step away from becoming endangered; a species of animal whose population has been slowly declining, due primarily to a loss of habitat, environmental contamination, or severe competition with exotic species (see rare, endangered).

tolerance level: that distance at which one species will allow another animal, especially his own species, to invade his or her territory or home range without a threat of physical combat (see social limits, territory).

transplant: to capture and remove a species of animal from one place to another compatible habitat where the introduced animal(s) can be expected to become established (see recovery plan, reintroduction, stocking).

tree: a plant with a main central woody trunk and a canopy of branches and leaves, usually over ten feet tall (see forest, grass, shrub).

tundra: a treeless area of arctic regions with subsoil that is permanently frozen, known as "permafrost," and vegetation consisting of lichen and moss (see biome, biotic community).

vegetation: a collection of various species of plants that provide the basis for a "biotic community" (see biotic community, ecosystem).

veldt: an open grazing area of South Africa, similar to North American grassland plains (see grassland, rangeland, savanna).

vertebrates: animals with backbones (see amphibian, bird, fish, mammal, and reptile, also invertebrates).

viable: capable of living, growing, reproducing and developing, such as a viable population of animals; relative to vigor of plants (see birth rate, survival rate).

warm-blooded: an animal having a constant warm body temperature, not related to the external

surroundings, but derived from the energy provided by the digestion of food; an endothermic animal such as mammals and birds (see cold-blooded).

waterfowl: birds that swim, esp. ducks, geese and swans, as opposed to shorebirds or wading birds which do not swim or float on water, all of which are usually migratory species generally found near water (see marsh, wetlands).

watershed: the area drained by a given stream or river; that area which is upstream of a given point; a watershed may be only a few acres in size or encompass thousands of square miles, such as the Columbia, Colorado or Missouri River "basins."

weeds: common name for forbs which are often important wildlife food but have no known use for humans; "a plant whose virtue has not yet been discovered" (see forb, grass, succession).

wetlands: swamps or marshes, predominantly composed of water and water-loving (hydrophylic) plants and animals, especially suited to waterfowl and shorebirds (see habitat, grassland, forest, desert).

wild: living in a free, unrestrained existence, not domesticated or tamed; more adapted to living in the wild and unable to live and reproduce well in captivity. Some animals such as mallard ducks are more easily domesticated than others, but most wildlife species, especially the predators, are almost never completely tame, even in a zoo, and cannot be completely trusted as domestic pets (see domesticated, feral, wildlife).

wildlife: animals that exist entirely in a wild state where they live and reproduce freely and are not capable of easy capture or domestication.Wildlife includes, in its broadest sense, all animals in the wild, including invertebrates (arthropods, crustaceans, and mollusks) fish, reptiles, amphibians, birds and mammals (see domesticated, feral, wild).

wildlife management: the science and art of applying the most advanced knowledge and technical skill to protect, preserve, enhance, conserve, and extend the value of the wild animals of the earth, whether for consumption as hunted species or totally protected as endangered; also the process of manipulating wildlife habitat for optimum conditions for resident or migratory wildlife (see endangered, recovery plan).

wilderness: a large area of land where nature is given primary consideration and there is virtually no impact from humans or civilization – no sound, sight, or smell of mechanization or human development; where human activities have minimal impact on the area and the area appears to be entirely natural (see refuge, preserve).

wildlife agency: a state or federal organization charged by law with the management of wildlife; state agencies are charged with the control of resident species within each state while the federal agency manages the migratory species and controls the interstate shipment and importation of all wildlife into the country (see conservation agencies and organizations, wildlife management).

zero population growth: a stable population of animals whereby the reproduction rate is equal to attrition (death rate); the increase in young animals simply replaces the number of animals lost from a population so as to maintain a fixed level of animals in a given area or given amount of time, often determined by the carrying capacity of that given area of land; applicable to all animal populations, including humans (see population dynamics, survival rate).

zoologist: a biologist who studies animals; zoology is the study of animals (see botanist, ecologist, entomologist, herpetologist, ichthyologist, mammalogist, ornithologist)

zooplankton: minute or microscopic aquatic animal life that feed on phytoplankton and provide a primary food source for aquatic organism such as crustaceans, mollusks, turtles and fish (see aquatic, phytoplankton, plankton)

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